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COST OF PRODUCTION AS A MILK PRICE DETERMINANT

BY

HARRY ALBERT ROSS
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THESIS

**SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY
SUPERVISION BY Harry Albert Ross
ENTITLED Cost of Production as a Milk
Price Determinant

BE ACCEPTED AS FULFILLING THIS PART OF THE REQUIREMENTS FOR
THE DEGREE OF Master of Science in Economics

E. L. Bogart
In Charge of Thesis

Head of Department

Recommendation concurred in*

Committee

on

Final Examination*

*Required for doctor's degree but not for master's

W. J. ALD

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COST OF PRODUCTION AS A MILK PRICE DETERMINANT

I. INTRODUCTION

Dairying Under War-time Conditions

After the United States entered the World War, rapid price changes occurred with resulting maladjustments in industry and agriculture similar to those which occurred at the beginning of the Civil War. The prices of grains mounted rapidly but the prices of animal products, and especially of dairy products, lagged behind.¹ Producers of milk for fluid consumption were seriously affected by these changes. The consuming public, long accustomed to a uniform retail price for milk, objected vigorously to any advance and voiced its disapproval each time the price was increased by decreasing the amount of milk normally consumed.² The urban population regarded the price of milk no differently than it did the five-cent street car fare, the price of bread or beer, or any of the other commodities or utilities for which it was accustomed to pay a uniform price. However, this attitude of the consumers tended to keep down milk prices paid the producers at a time when feed costs were increasing rapidly.

The dissatisfaction among dairymen resulting from this condition led to milk strikes in many districts where farmers were organized, and stimulated

¹Warren, G. F., Prices of Farm Products, Jour. of Farm Econ. II, No.2, Apr., 1920, pp. 61-69.

Do. Prices of Farm Products in the United States, U.S.D.A. Bul. 999.

²Milk Inquiry, Hearing at Chicago, Dec. 26, 1917, p.3120.

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the formation of bargaining associations in unorganized territory. Since milk is so vitally important in the human dietary, the closing of a city's supply by a strike of only a few days duration was a threat against the welfare of the people. If the territory was well organized, enough milk could be held back from the city so that condensed milk or milk of a poor quality brot in from outside the regular zone had to be substituted for the usual fresh product. Hence, when a strike was called, the city press invariably clamored for the suppression of the farmers' organizations and in many localities the officers and directors of the co-operative associations were indicted under the anti-trust laws. In other instances, wiser action was taken by leaders of the milk producers, the milk distributors, and various state and federal officials who attempted to find some method of price determination which would supply the consumers with milk at a reasonable cost and would at the same time give the producers a price which was high enough to keep the industry in a healthy state of stimulation in order to insure an adequate supply for the future.

The Chicago Dairy District

The various phases of dissatisfaction, strikes, indictments, investigations, and price fixing, which was typical of the whole dairy industry, were experienced in full by the dairymen producing for the Chicago market. The district which supplies Chicago with approximately 1,000,000 quarts of milk daily covers parts of three states and comprises a region somewhat rectangular in shape extending almost two hundred miles north and south and about one hundred miles east and west.¹ Northern Indiana, having excellent

¹Hibbard, B. H., and Erdman, E. H., Marketing Wisconsin Milk, Wis. Agr. Exp. Sta. Bul. 285, p. 21, 1917.

transportation facilities, sends some milk to Chicago around the southern end of Lake Michigan but this constitutes only a small part of the city's supply. The region south of Chicago has as good means of transportation as any other part of the dairy district but produces relatively little milk. This is due largely to a competing type of agriculture, corn-growing being more profitable than dairying. To the west of the city, dairying as the principal farming enterprise gradually gives way to a more general type of agriculture in which the feeding of hogs and steers plays an important part. In this region considerable quantities of butter fat and of milk for condensing are produced. The district extends north from the city well up into Wisconsin, overlapping the Milwaukee milk zone and tapping the butter, cheese, and condensing region which produces an enormous amount of milk for manufacture. It is quite evident, therefore, that the Chicago fluid milk district is not only capable of great expansion to meet the needs of an increasing population, but that the territory to the north is already fully developed as a dairy region. Much of the milk which is produced for manufacture in that region can be diverted to the city for fluid consumption if the price of whole milk is very much higher than the price obtained for milk used in the manufacture of the various products. This alternative market for milk has a very marked influence upon Chicago milk prices and is a disturbing factor in any system of price determination.

Dairymen's Organizations

The advantage of collective action in obtaining fair prices for milk was early recognized in this region and various associations were formed. Dairymen in the Chicago district were organized in 1887 under the name of "The Milk Shippers' Union of the Northwest" but the company failed to fulfill

expectations and soon disappeared.¹ In 1897 a second company was incorporated as "The Milk Shippers' Union"² and this company continued until June, 1911, at which time the Milk Producers Association took over the activities of the older association.³ The Milk Producers Association was primarily a bargaining agent, giving the dairymen a much stronger voice in the determination of prices than was possible under the old system of the individual farmer contracting with the dealer.

Before the formation of this association, milk distributors and condensing companies posted prices twice a year stating the amount they would pay for milk during the following six months. A short period, usually of about two weeks, was allowed the farmers in which to sign the contracts at those prices. If a farmer refused to sign within the specified time, his milk was turned back from the plant or factory. If no other milk plant was within practicable hauling distance of his farm his only alternative was to find a buyer in Chicago to whom he could ship his milk directly. In one instance, the prices paid by a company were determined in the head office of that company in New York and the local plants were then ordered to pay these prices for the ensuing six months.⁴ As this company owned a number of plants and was one of the largest buyers of milk in the Chicago territory, many other companies adopted their prices and, as a consequence, it was commonly charged by the producers that milk prices were arbitrarily set in New York.

These arbitrary methods of price fixing were more or less successfully opposed by the Milk Producers Association. However, this bargaining agent

¹Rural New Yorker, Sept. 17, 1887.

²New York Produce Review, Nov. 24, 1897.

³Milk News, June, 1911.

⁴Milk Inquiry, Hearing at Chicago, Jan. 3, 1918, pp. 3845-3847.

did not solve the problem of surplus milk¹ and the outgrowth of this was the formation of the Milk Producers Co-operative Marketing Company and the pooling method of marketing milk which will be discussed later. Altho the Marketing Company² was started in 1916, it was not fully organized or prepared to market the milk of its members until January, 1919.

Statement of the Problem

As a result of the abnormal war-time conditions, an agreement was reached in July, 1918, between the milk producers in the Chicago dairy district and the milk dealers, whereby the prices paid for milk during the ensuing five months were to be determined by applying current values of feed and labor to a cost of production formula which had been evolved after a long period of investigation. This cost computation was made each month by the Department of Dairy Husbandry of the University of Illinois, and the value thus obtained was accepted by the producers and the distributors as the price to be paid for milk at the receiving stations in the country.

This method of price determination was used for the period agreed upon (August to December, 1918) with apparent satisfaction to all concerned. For these five months and for January, 1919, following the expiration of the agreement, the computed costs and the milk prices were identical. There was no over-production of milk during this period because the dairymen felt that the price covered cost of production only, no allowance for profit having been made in the formula. On the other hand, milk prices were relatively high and the outlook for the future of the industry was considered promising. Many producers would have been glad to have continued the cost method of setting

¹By surplus milk is meant the milk produced in excess of the amount consumed in fluid form.

²Synonomous with Milk Producers Co-operative Marketing Company.

prices but, beginning with February, 1919, the producers' marketing organization and the milk dealers reverted to their previous method of bargaining. The cost computations, however, were used by the producers as a basis for bargaining and for the next nine months the price obtained for milk was almost the same as the formula cost of production.¹

The price paid by the dealers for milk testing 3.5 percent and the formula cost of production for each month from September, 1918, to December, 1921, are given in Table 1 and shown graphically by Fig. 1.⁽²⁾ The dealers' prices, however, do not represent the prices received by the producers except for the last five months of 1918. Beginning with January, 1919, most of the milk produced in the dairy district tributary to Chicago was sold thru the Milk Producers Co-operative Marketing Company. This organization acted as a bargaining agent for the dairymen in the sale of their milk and also manufactured various dairy products from the surplus milk. The price paid to the producers by the Marketing Company was a pool price representing the average price obtained for all of the milk, whether it was sold for fluid consumption and manufacture or was converted into manufactured dairy products in the plants owned or leased by the company. The value of milk for manufacture, especially during 1920 and 1921, was very much lower than the value of market milk and as a result the pool price to the producers during the entire period ranged from 1 to 10 percent below the dealers' price and on several occasions fell even lower than this. It will be noted from Fig. 1 that the pool price shows great irregularity for May, 1921, and has not been plotted for the

¹The terms, "formula cost of production", "theoretical cost of production", and "computed cost of production" are here used synonymously as distinct from "real cost of production".

²References to charts and tables are of the form used in publications of the Illinois Agricultural Experiment Station.

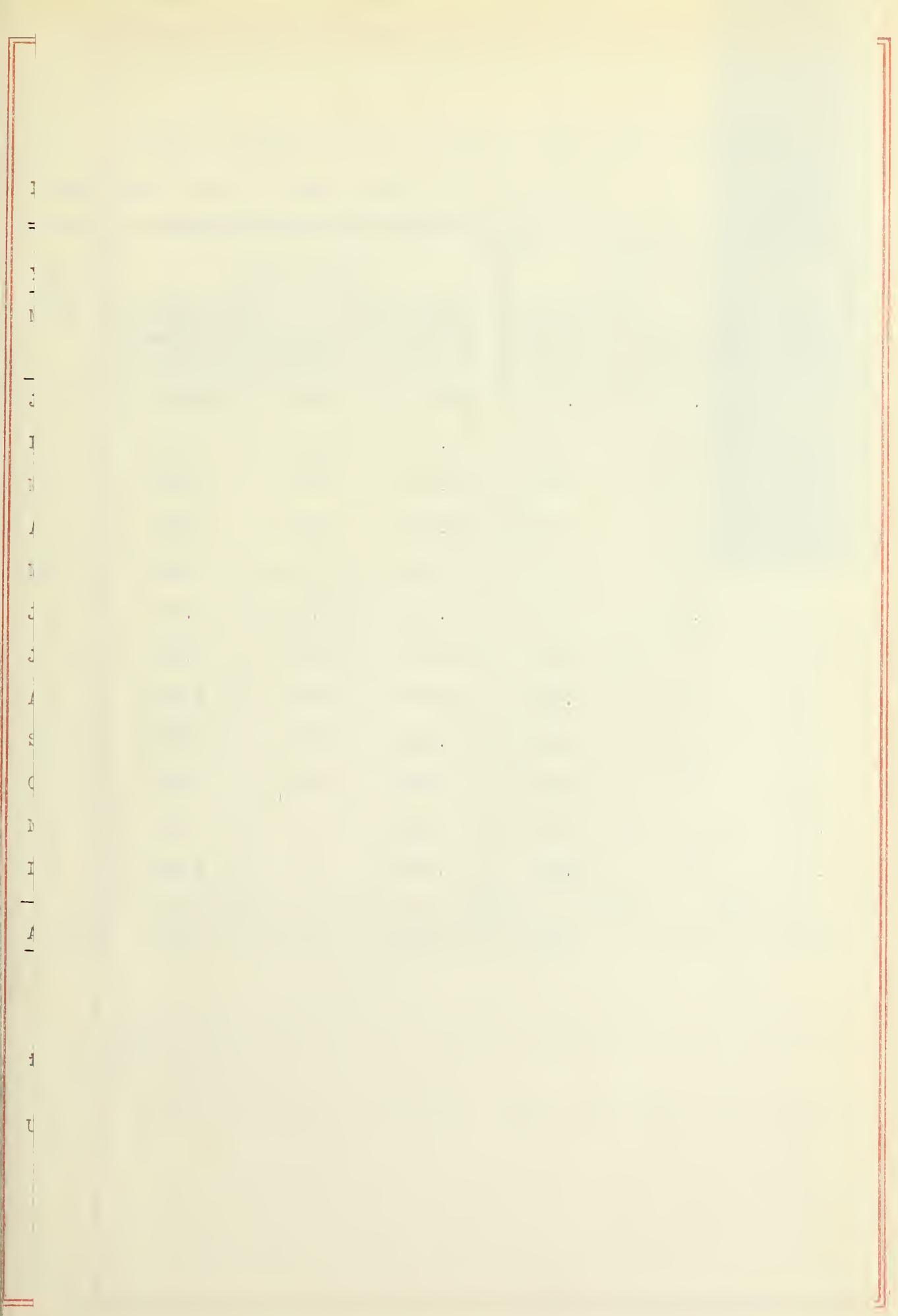


Table 1.- Prices Paid for 3.5 Percent Milk in the Chicago

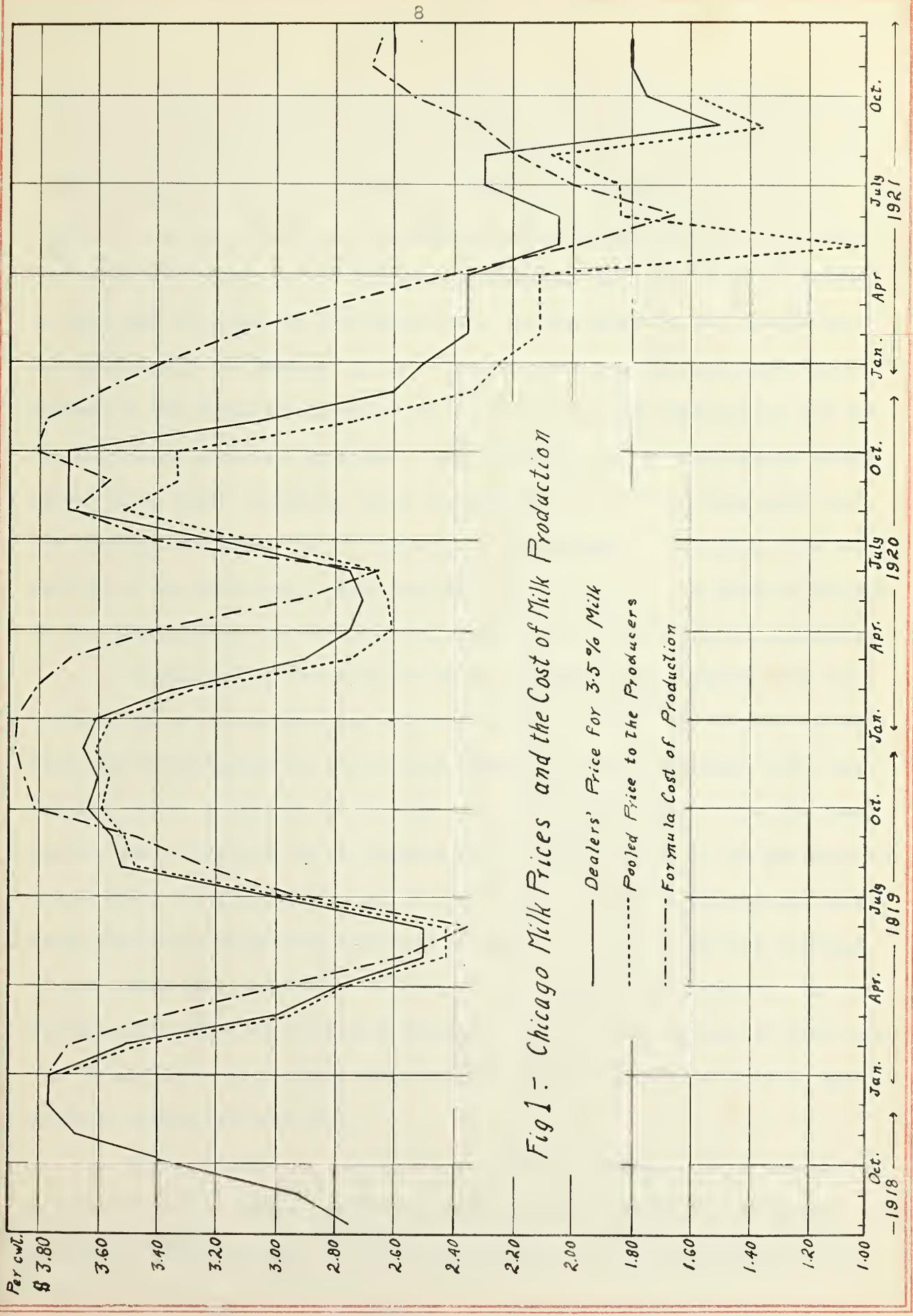
Dairy District and the Formula Cost of Producing Milk

Year	1918			1919			1920			1921		
Month	1Dealers' price per 100 lbs.	2Pool price per 100 lbs.	3Formula cost per 100 lbs.	Dealers' price per 100 lbs.	Pool price per 100 lbs.	Formula cost per 100 lbs.	Dealers' price per 100 lbs.	Pool price per 100 lbs.	Formula cost per 100 lbs.	Dealers' price per 100 lbs.	Pool price per 100 lbs.	Formula cost per 100 lbs.
Jan.	\$---	\$---	\$---	\$3.76	\$3.72	\$3.76	\$3.60	\$3.56	\$3.88	\$2.50	\$2.25	\$3.38
Feb.	---	---	---	3.50	3.46	3.70	3.35	3.28	3.81	2.35	2.11	3.11
Mar.	---	---	---	3.00	2.97	3.40	2.90	2.75	3.70	2.35	2.11	2.80
Apr.	---	---	---	2.80	2.77	2.99	2.75	2.61	3.40	2.35	2.11	2.41
May	---	---	---	2.50	2.42	2.57	2.70	2.62	2.92	2.05	1.02	1.99
June	---	---	---	2.50	2.42	2.35	2.75	2.67	2.66	2.05	1.84	1.66
July	---	---	---	3.00	2.97	2.94	3.20	3.10	3.40	2.30	1.84	1.99
Aug.	2.75	---	2.75	3.52	3.48	3.23	3.70	3.51	3.69	2.30	2.07	2.18
Sept.	2.92	---	2.92	3.55	3.51	3.46	3.70	3.33	3.56	1.50	1.35	2.31
Oct.	3.32	---	3.32	3.63	3.59	3.82	3.70	3.33	3.81	1.75	1.57	2.54
Nov.	3.68	---	3.68	3.60	3.56	3.85	3.05	2.74	3.78	1.80	---	2.68
Dec.	3.77	---	3.77	3.65	3.61	3.88	2.60	2.34	3.59	1.80	---	2.65
Average	---	---	---	3.25	3.21	3.33	3.17	2.99	3.51	2.09	---	2.47

1Milk prices obtained from the Bowman Dairy Company, Chicago, Ill.

2Pool prices obtained from the Milk Producers Co-operative Marketing Company, Chicago, Ill.

3Formula costs from the original computations, Dept. of Dairy Husb., Univ. of Ill.



months of November and December of that year. For some months previous to May, the 10 percent spread between the dealers' price and the pool price was not sufficient to cover the difference between the value of fluid milk and the value of milk sold or used for the manufacture of other products. As a result the Marketing Company became involved in financial difficulties and in order to take care of a part of the liabilities, the May price to the farmers was set at one-half the dealers' price. The dairymen, for the most part, were unaware of the financial condition of their co-operative organization and the May assessment came as a surprise. Approximately half of the members immediately broke their contracts, which provided for the sale of their milk thru the company, and began selling directly to the dealers. Following this the decline of the Marketing Company was rapid and because of the involved affairs of the organization, the November and December pool prices are not available.

If the milk prices obtained by the producers are compared with the formula cost of production computations (Table 1 and Fig. 1), it will be seen that only twice during the period from October, 1919, to December, 1921, was the pool price as high as the formula cost of producing milk. For the other months, the prices paid to the farmers ranged from \$.11 to \$ 1.25 per hundred-weight below the theoretical cost of production. It might be supposed that these conditions would have curtailed production and that a serious shortage of milk would have resulted. Contrary to this supposition, however, the Chicago milk market was virtually flooded during the greater part of this time and the district has probably never known as great a surplus of milk as was produced during 1920 and 1921.

It is proposed in this thesis to trace the development of the cost of production formula and to analyze the seeming anomaly whereby an enormous surplus of milk was produced during the period of two years when milk prices

were approximately 20 percent below the theoretical cost of production. The formula and the method of its application in computing this theoretical cost of producing milk will be examined in order to determine whether or not the computed cost of production was the same as the real cost of production. In addition, a number of economic factors which influence the production of milk will be discussed in relation to the cost method of determining milk prices and some conclusions will be drawn from the study in regard to the practicability of fixing city milk prices by the use of cost formulas.

II. DEVELOPMENT OF THE COST FORMULA

Events Preceding the Period of Price Fixing

In the spring of 1916 the Chicago Milk Producers Association and the milk dealers failed to reach an agreement in regard to milk prices for the ensuing six months. As a result, milk was withheld from Chicago for the first week of April and the city's milk supply was curtailed to such an extent that the dealers were forced to agree to the prices demanded by the producers.¹ The success of this milk strike strengthened the dairymen's co-operative organization and its membership was greatly increased, reaching a total of about 11,500 by October.²

The increase in the price of milk, however, did not keep pace with the increase in the price of feed which advanced rapidly in the fall of the same year (1916). During this period, mill feeds advanced at a much slower rate than corn. This was due to the fact that, altho corn normally constitutes about half of the concentrate ration for dairy cattle in the Chicago district, the proportion of the total corn crop so used is too small to have any great effect upon the aggregate demand. Mill feeds, on the other hand, find their principal market in dairy regions and the prices of such feeds are much more intimately related to the prices of dairy products.

Table 2 and Fig. 3 show by the use of index numbers, the lag in milk prices as compared with corn and mill feed prices. The five-year average, January, 1909, to December, 1913, for each month was taken as the base, 100.

¹Hoard's Dairyman, Apr. 14, 1916, p. 511.

²Milk News, Oct., 1916, p. 4.

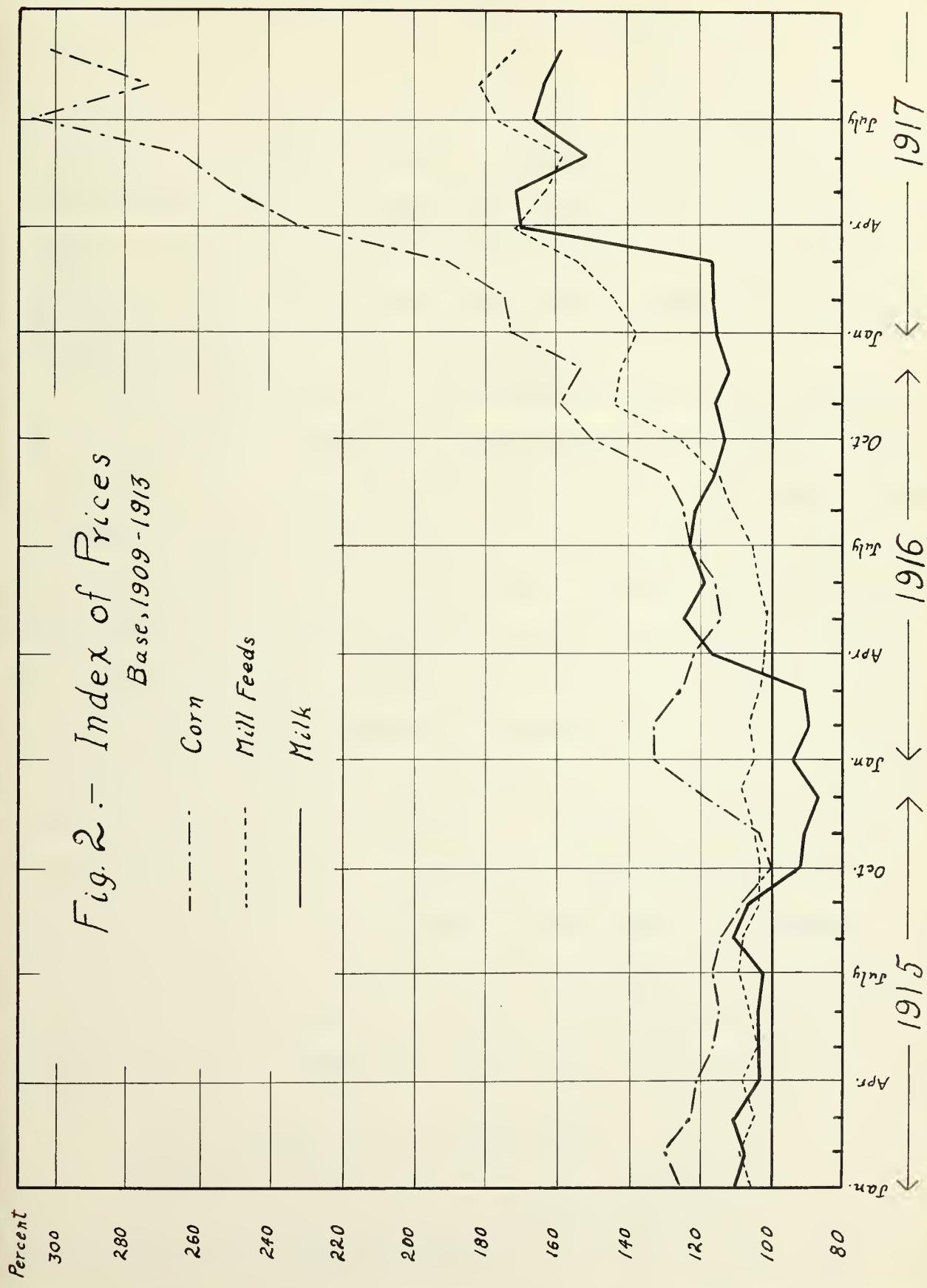
Table 2.- Index Numbers of Milwaukee Wholesale Prices of Mill Feeds,
 Chicago Corn No. 2, and Prices Paid Farmers for Milk in the Chicago District
 Base, 1909-1913

Month	1915			1916			1917		
	1Mill feeds	2Corn	3Milk	Mill feeds	Corn	Milk	Mill feeds	Corn	Milk
Jan. --	106	126	110	105	132	93	138	172	115
Feb. --	109	130	107	106	132	89	144	174	116
Mch. --	105	122	110	103	125	90	154	189	116
Apr. --	108	121	103	102	122	117	171	232	170
May --	103	117	103	101	114	124	163	251	171
June --	106	115	104	104	115	118	159	264	151
July --	109	116	102	105	122	122	177	306	167
Aug. --	108	114	110	111	124	121	181	273	163
Sept. --	103	108	106	114	129	116	171	301	158
Oct. --	103	100	91	125	151	113			
Nov. --	104	103	90	144	159	115			
Dec. --	108	119	87	142	153	111			

¹Daily reports of the Western Feed Market Bureau, Milwaukee, Wis.

²Board of Trade, Chicago, Annual Reports.

³Milk News.



For the six months, October, 1916, to March, 1917, the milk index was practically constant, ranging only from 111 to 116. Mill feeds, however, increased from 125 to 154 while corn went from 151 to 189. This increase in feed prices resulted in the dairymen demanding and receiving a schedule of prices for the next six months (April to September) which brought the milk price index up to 163 as an average of the period.¹ Mill feed prices were on approximately the same level as milk, but corn prices had continued to ascend at a rapid rate and the average index number for the six months was 271.

When the delegates of the Milk Producers Association met September 21, 1917, to discuss milk prices for the next six months, their demands were based upon conditions in the industry indicated by the price index. Mill feeds were 71 percent and corn 201 percent above the five-year average, while milk prices were only 58 percent above the pre-war level. National Food Administrator, Herbert Hoover, had requested that milk prices be set from month to month instead of the usual method of setting them for six months in advance, and, therefore, the asking price for October only was agreed upon at this time. This was determined by averaging the prices demanded by the delegates of the various locals of the association.² The result was a price of \$ 3.42 per 100 pounds of milk testing 3.5 percent. The delegates voted to demand this amount for October and at the same time authorized the milk board³ of the association to set the price for the next five months provided it was not less than \$ 4.00. The strength of the Milk Producers Association had been shown by the strike in April, 1916, and the increase of \$ 1.12 over the September price of \$ 2.30

¹Hoard's Dairyman, Apr. 13, 1917, p. 542.

²Ibid. Oct. 5, 1917, p. 332.

³A committee of the directors authorized to deal with the distributors and manufacturers in setting milk prices.

was accepted by the milk dealers with much less objection than had been anticipated by the producers.

When the price schedule had been made in April, 1917, the increased price paid the producer was passed on to the consumers by raising the retail price of milk from 9 to 10 cents a quart and this was increased to 13 cents when the October price of \$ 3.42 was agreed upon. Announcement of the new price was followed by a raid upon the office of the Milk Producers Association on September 26 by representatives of the State's Attorney. All of the books and correspondence of the association were seized for the purpose of obtaining evidence of any illegal practices of the producers in enforcing their demands for higher milk prices.¹ On October 17, the Cook County grand jury returned true bills against the following members of the association who formed the milk board which passed finally upon the milk price and contracts for October: Charles H. Potter, Clinton J. Cooper, William J. Goodwin, Arnold Huber, and Roy Lewis. The indictment charged restraint of trade by the formation of a combine to fix the prices at which milk should be sold in Cook County and to eliminate all competition between milk dealers in the selling of milk. Before these men came to trial, the secretary, W. J. Kittle; the treasurer, F. H. Reese; and a director, R. M. Omann, had been indicted on the same charges.

Altho the eight officials were found not guilty on all counts when the case was finally tried, the action of the State's Attorney in bringing the indictments because of the increased milk prices, encouraged the milk dealers to resist the demands of the producers in regard to the November price. One company offered \$ 3.00 per hundredweight² and another³ offered an average

¹Milk News, October, 1917, p. 5.

²Prairie Farmer, Nov. 17, 1917, p. 6.

³Milk News, February, 1918, p. 10.

price for the next five months of \$ 3.21, while the locals of the association asked various prices ranging from \$ 3.42 to \$ 3.71. A number of small dealers in Chicago paid \$ 3.42 and continued to receive milk after November 1, but the refusal of the larger companies to pay the price asked, again resulted in much of the milk being withheld from the city. With the question of the legality of collective action in the sale of milk still undecided, the dairymen took care to claim that they were acting as individuals in withholding their milk altho there were charges that a few producers were forced to haul their milk back to the farm and a few cans were dumped upon the road. A serious milk shortage was imminent when Harry A. Wheeler, Illinois Food Administrator, presented a plan of mediation on November 2 which was accepted by both the dealers and the producers, and the deadlock was broken.

In brief, his plan was as follows:¹ The producers were to accept \$ 3.22 for their November and December milk, but in the meantime a commission was to be appointed which would determine the cost of producing milk and also decide upon what constituted a reasonable profit. Milk prices were to be set by the commission for six months beginning January, 1918. If \$ 3.22 was found to be too low for November and December, the loss was to be made up by an added increase to the price for the following six months. The retail price of milk was to be reduced to 12 cents per quart for the months of November and December and the investigation was to cover the cost of distributing milk as well as the cost of producing it.

Altho some dissatisfaction was manifested by the producers because of the compromise price of \$ 3.22, in general, they were content to await the decision of the milk commission, believing, however, that the price was below

¹Prairie Farmer, Nov. 17, 1917, p. 6.

the actual cost of production and would be increased as provided for in Wheeler's plan.

The Chicago Milk Inquiry

Upon the agreement of the producers and the distributors to accept the findings of the milk commission, Mr. Wheeler, acting for the United States Food Administration, appointed as members of the committee the following persons:¹

John S. Miller, Attorney, Chairman

W. J. Kittle, Secretary of the Milk Producers Association

John J. Fitzpatrick, Manager of Borden's Farm Products Company

John Harris, President of the Wisconsin Butter and Cheese Company

Eugene Davenport, Dean of the College of Agriculture, University of Illinois

P. G. Holden, Farm Advisor for the International Harvester Company

Mrs. Edward P. Welles, Women's organizations of Chicago

John W. O'Leary, President of the Chicago Association of Commerce

Lucius Teter, President of the Infants Welfare Society.

In addition to these nine members, the City of Chicago, the State's Attorney, the Federal Department of Justice, the State Council of Defense, and the Chicago Federation of Labor were permitted to name representatives who acted in an advisory capacity.

The Commission held public hearings from December 3, 1917, to January 31, 1918, during which time evidence consisting of 5,874 pages of testimony was presented by the producers, the distributors, the City of Chicago,

¹Hoard's Dairymen, Dec. 7, 1917, p. 695.

the State's Attorney, and the City Club. Testimony was given under oath and the hearings were conducted somewhat after the usual court procedure altho greater latitude was permitted in the giving of testimony and in cross-examination of the witnesses. At times the real purpose of the inquiry was apparently lost sight of by some of the attorneys and the hearings were often enlivened by tilts between Charles S. Deneen, ex-governor of Illinois, who appeared for the Milk Producers Association, and Nicholas Michels, who appeared for State's Attorney Hoyne. Michels was apparently in search of evidence to use against the eight indicted officials of the association whose case was then pending, while Deneen had been retained as chief counsel by the defense.¹

The evidence relating to the cost of milk production presented by the producers was of two general kinds:

1. Cost investigations conducted by colleges of agriculture.
2. Cost records kept by individual dairymen in the Chicago dairy district.

Of the first type of evidence, the studies of F. A. Pearson of Illinois and of G. F. Warren of Cornell were outstanding. Pearson's work was based upon cost accounting studies which had been conducted by the Department of Dairy Husbandry for other purposes but which were available for the milk inquiry. The data he presented were obtained from 36 farms² on which there were 873 cows producing 5,383,992 pounds of milk during a two-year period, from the spring of 1914 to the spring of 1916. He found that the miscellaneous minor costs of producing milk, such as interest, use of buildings and equipment, insurance, taxes, veterinary fees, medicines, salt, fly protector, etc.,

¹Milk Inquiry, Hearing at Chicago, Dec. 7, 1917, p. 878.

²Pearson, F. A., The Cost of Milk Production, Ill. Agr. Exp. Sta. Bul. 216, 1919.

approximately equaled the returns net milk, including appreciation in young stock, the value of the manure, the calves sold, and a few small items. Hence, the net cost of producing milk was roughly equal to the expense of man labor and of feed exclusive of pasture. The feed and labor cost, Pearson expressed in terms of commodities to which could be applied current values at any given time. His findings, as presented to the Commission, were summarized in the following formula for the cost of producing 100 pounds of milk:

Grain -----	44 pounds
Silage -----	188 pounds
Hay -----	50 pounds
Other roughage -----	39 pounds
Man labor -----	2.42 hours.

The above formula represented the average annual cost of producing milk and as the monthly cost varied widely because of the seasonal differences, it was necessary to make some adjustments in the formula in order to determine the cost of milk production for any one month. This, Pearson did by multiplying the average year cost by corrective factors representing the monthly deviation from the average annual price of Chicago milk for the ten years, 1907 to 1916, assuming that the variation in prices during that period was sufficient to stimulate a uniform production of milk throughout the year.

The percentage variations follow:

January	119.0	July	83.7
February	114.3	August	94.2
March	103.5	September	96.7
April	94.2	October	109.2
May	73.2	November	118.3
June	70.6	December	120.3

Professor Warren's study was based upon conditions obtainin- in New York and altho presented in slightly different form, showed substantially the same results as Pearson's work, thus servin. as a check upon the accuracy of the latter.

Many of the cost records presented by individual dairymen had been kept for a number of years under the supervision of the Department of Dairy Husbandry of the University of Illinois, While others had been obtained since the question of determining the cost of milk production had been brought into prominence. As would be expected, these individual records showed widely varying costs because of the differences in the season of production, the number of dry cows and the amount of young stock, the production of the herds, and the methods of management. Such variations were pointed out by the groups interested in maintaining low milk prices as indicating innaccuracy in keeping the accounts.¹

J. B. Bain of the Dairy Division of the United States Bureau of Animal Industry who had charge of a cost accounting investigation in Indiana, was called by one of the Consumers' interest groups with the apparent expectation that he would present evidence contradictory to the Pearson formula but instead, his work tended to substantiate that of Pearson.²

As the testimony presented by the distributor and the consumer groups had very little bearing upon the subject of this study, reference to it will be omitted except in so far as it relates to a much argued question of accounting practice. The producers held that farm-grown feeds should be charged to the cows at market prices less the cost of transporting them to market. Those interested in low milk prices charged that this procedure resulted in a double

¹Milk Inquiry, Hearing at Chicago, Jan. 17, 1918, pp. 5102-5111.

²Milk News, Jan., 1918, p. 10.

profit, one on feeds and another on milk, and maintained that farm-grown feeds should be charged at cost of production. It was the consensus of opinion of the foremost men in charge of farm cost accounting investigations that feeds should be charged at market prices.¹ Industrial accountants brought in by the consumer group, however, testified that accepted accounting practice in industry required that raw materials be charged at cost.² Professor Andrew Boss of Minnesota was called to Chicago by the City Club but when his views were found to be in accord with those of the other farm accountants, he was permitted to return without testifying.³ The contention of the producers in regard to the correct method of charging farm-grown feeds was eventually upheld in the application of the formula which was evolved.

Report of the Milk Commission

When the arbitration agreement was entered into on November 2, it was assumed that the hearing would be completed by the middle of December, and that by the first of January, 1918, the Milk Commission would announce prices for the next six months. That date, however, found the hearing only about half completed and the price agreement of \$ 3.22 was continued thru January by common consent. It was not until February 2 that the report of the Commission was issued. The findings of the Committee were given out in the form of a majority report signed by Miller, O'Leary, Teter, Welles, Fitzpatrick, and Harris. At the same time dissenting minority reports were issued by Davenport, Kittle, and Holden.

¹Warren, C. F., Farm Management, p. 55, 1916.
Deneen, Chas. S., Brief of Argument for N. P. A., pp. 3-10

²Milk Inquiry, Hearing at Chicago, Jan. 15, 1918, p. 5112.
Ibid. Jan. 17, 1918. p. 5520.

³Ibid. Jan. 15, 1918, p. 5128.

The report of the majority of the Milk Commission as sent to Food Administrator Wheeler was very different from what had been anticipated by the producers. Discouraged by the apparently conflicting evidence on the cost of milk production, and seemingly desirous of giving Olisa a twelve-cent milk, the majority of the Committee decided that the prices received by the producers before the war represented cost of production plus a reasonable profit at that time. They therefore concluded that by increasing the prices received during this pre-war period by a weighted index number of feed and labor, cost of production plus a reasonable profit would be obtained for the period under dispute. Stated in the words of the report:¹

"Two methods of determining the cost of production were offered in the proceedings. One method is based on a formula giving quantity and price of feed and labor and incidentals required for production of one hundred (100) pounds of milk. The second method is based on the price and quantity of butter fat contained in one hundred (100) pounds of milk."²

"The difficulty presented by the first method is due to inability to determine either cost of production or market price of ALL items of feed and quantities of each. There exists a variety of opinions on the amount of feed purchased and the value of home grown feeds. The evidence offered by experts and farmers as to their cost of production by the application formula introduced by the producers showed wide variations of cost extending from \$ 2.05 to \$ 12 per one hundred (100) pounds. This shows the impossibility of determining cost of production from such evidence. *****" ¹¹

¹Milk News, February, 1918, p. 1.

²The second method was introduced by the representatives of the consumers.

"It would appear from the testimony that the dairy industry in the Chicago district had been a reasonably successful industry during a normal period of eight years preceding the war period. Lands had increased in value - improvements had occurred. The financial worth of those engaged in the industry had materially improved. That profits had not been excessive is indicated by the normal increase in the supply to fill the demand. Because of the nature of the industry, had profits been excessive an over supply would have followed; had they been unsatisfactory, a shortage would have been the result."

"The Commission finds an unusual situation existing at the present time. This is a season of heavy surplus. The transportation congestion in the East and at the Seaboard has made it difficult to ship condensed milk and other products which under ordinary conditions would absorb the surplus. Warehouses are already filled with these products awaiting transportation. Chicago has reduced its milk consumption, occasioning even greater surplus."

"The Commission have therefore selected as a base representing cost of production and a fair profit, the average sale price per one hundred (100) pounds over the years 1908 to 1915 inclusive. The result, of course, does not represent present value, due to the large advance in cost of feed and labor since that time. The quantity of feed and labor per one hundred (100) pounds of milk, however, is the same in both periods. Considering the eight year period as a base and distributing feed and labor on a basis of 100 per cent total the Commission developed the following ratio:

19 ½ Home Grown Grains

19 Mill Feeds (wheat bran, wheat middlings, hominy, cotton seed meal, oil meal, gluten feed, dry salt).

35 Hay (including silage valued at the ratio of 3 tons of silage to 1 ton of hay).

27 Labor

"It was agreed by the Commission that variation in the price of those four units represents with sufficient accuracy when applied according to the above ratio the increase or decrease in the cost of production of milk. The only criticism made to this base or this plan was by a minority of the members of the Commission that the price to the producer during the eight year period referred to was not satisfactory to them."

The weighted average cost of feed and labor for November, 1917, was found by the Commission to be 77 percent above the base period. The eight-year average price for November milk was therefore increased 77 percent and called the cost of production plus a fair profit for that month. In a like manner the prices for the following seven months were determined using the November index for each month despite the fact that feed prices had increased greatly since that time, so that the index number of 177 was too low even at the time the Commission reported the prices (Feb. 2, 1918). The following prices were set by the Commission for the ensuing six months: February, \$ 3.07; March, \$ 2.83; April, \$ 2.49; May, \$ 2.04; and June, \$ 1.80. They further recommended that the November, December, and January prices be left at \$ 3.22 altho according to their findings, the price should have been \$ 3.13, \$ 3.20, and \$ 3.15, respectively.

The dissenting members disagreed with the view of the majority of the Committee in regard to the assumption that prices received during the eight-year period represented cost of production plus a fair profit. They pointed out that the distributors admitted before the Commission that prices were formerly named by the dealers without giving the dairymen an opportunity to barter. This, they declared, resulted in the naming of prices which, at best, gave bare cost of production and did not include a profit. The fact that the Milk Producers Association had its inception during this period was

taken as proof that prices were too low. Concerning this, W. J. Kittle says in his minority report:¹

"The only testimony on the part of the distributors as to the methods pursued by them before April, 1916, in fixing the price of milk is the testimony of the superintendent of the Elgin branch of Borden's Condensed Milk Company, who stated that it was the practice of his distributing company to have the superintendents make the inquiry about the prosperity or lack of it among the dairy farmers and then to meet in New York City and there fix the price for the dairymen's milk upon the general prosperity or lack of it among the farmers as observed by the superintendents, and without any investigation of or regard to the cost of milk production; in other words, to fix it upon 'what the traffic would bear'".

"Prices thus fixed without any consultation with the farmers brought so many hardships to the farmers that it led to the forming of their organization with the object of preventing a continuance of this arbitrary fixing of prices and terms of sale by the distributors. Under such conditions, this was found necessary, not only to preserve the herd of the individual farmer but to preserve the milk industry in the entire dairy district which serves the city of Chicago itself. The average of eight years adopted by the majority of the Commission covers those intolerable years of strife with the distributors and its application causes the Federal Government to prolong those bad conditions in the settlement of this controversy."

Both Kittle and Holden objected to the method of price determination as adopted by the Commission, as well as to the base period which was selected.

¹Milk News, Feb., 1918, p. 8.

They maintained that the cost formula as presented by Pearson, should be used since it had been substantiated by the work of other investigators. Holden, in his minority report, says:¹

"The majority of the Commission in fixing the prices to be paid to the producer for milk ignore the facts brought out in the sworn testimony of the witnesses in the hearing to determine the cost of milk production. The members of the Commission who have signed the report did not consider in their deliberations the evidence given by the authorities called to testify from the United States Department of Agriculture and the agricultural colleges; nor the testimony of the dairy farmers themselves who gave substantial evidence based on cost accounting and upon years of experience in the dairy business. In fairness to all concerned, producer, distributor and consumer, the findings of the Commission should certainly have been based upon the whole of the evidence. This was not done."

Dean Davenport in an open letter to Food Administrator Wheeler, upheld the method of price determination advocated by the majority but he agreed with Kittle and Holden in regard to the selection of the eight years, 1908 to 1915, as a base.² He believed that prices during that period covered cost of production only, and in order to obtain the desired cost of production plus a fair profit for the months under dispute, he felt that the base price should have been increased by ten percent before being multiplied by the index number, 177.

That the Commission failed to fulfill its obligations and deliberately violated its instructions, was freely charged by the dissenting members. Dean Davenport says:

"I must with regret express the conviction that my own opinions and

¹Milk News, Mich., 1918, p. 9.

²Ibid. pp. 9-10.

information and those of other agricultural college men and of the producers counted but lightly in the councils of the Commission."

"The majority proceeded from the assumption that Chicago must have 12-cent milk. Upon that point I obtained a clear expression of intention. This in my opinion violated both the instructions and the authority of the Commission."

Adoption of the Modified Formula

Upon the announcement of the findings of the Committee and the fixing of the February milk price at \$ 3.07, many producers again withheld milk from Chicago. As late as February 16, ten stations in Illinois and two in Wisconsin had not yet started shipping milk.¹ In response to numerous telegrams of protest, Food Administrator Hoover sent Mr. W. E. Lamb to Chicago to investigate the claims of the dairymen. He called together the Milk Commission to hear objections from a committee of the producers. Nothing was accomplished by this meeting as the majority of the Commission refused to change the prices originally set.² Scarcely had Mr. Lamb returned to Washington when resolutions of protest adopted by a convention of the producers held at Elgin, February 12, resulted in his again being sent to Chicago.

His second trip was more fruitful. After conferring with the Milk Commission, Mr. Lamb announced a modification of the Commissions report and a new set of prices.³ Table 3 shows the prices set by the Commission and Lamb's modified prices based upon index numbers for each month instead of upon

¹Milk News, Feb., 1918, p. 4.

²Hoards Dairyman, Feb. 8, 1918.

³Milk News, Apr., 1918, p. 2.

Table 3.- Comparison of the Chicago Milk Commission Prices, Lamb's Modified Prices, and the Prices Received for Milk in the Chicago District

	Milk Commission price computations	Lamb's price computations	Prices received for milk
1917 Nov. -----	\$ 3.13	\$ 3.13	\$ 3.22
Dec. -----	3.20	3.44	3.22
1918 Jan. -----	3.15	3.21	3.22
Feb. -----	3.07	3.15	3.07
Mar. -----	2.83	2.89	2.90
Apr. -----	2.49	----	2.65
May -----	2.04	----	2.05
June -----	1.80	----	1.80

the November index of 177, originally used. According to Mr. Lamb's computations, there was due the producers on March 1, 21 cents per hundredweight because of underpayment for milk during the preceding months, and this amount he added to the March computation of \$ 2.89, making the price \$ 3.10. The price for each succeeding month was to be set on the 15th of the month preceding, using a new index based upon feed and labor at that time. This was accepted by the producers but the manufacturers of condensed milk refused to pay anything more than the original prices set by the Commission, claiming that this was the only thing to which they had agreed. After several conferences between the Milk Board, the distributors, and the manufacturers, a compromise was effected and prices were fixed as follows: March, \$ 2.90; April, \$ 2.65; May, \$ 2.05; and June, \$ 1.80. These prices were adhered to by all parties and later the July price of \$ 2.30 was set by agreement.

June marked the end of the agreement between the producers and the distributors which had been entered into November 2, 1917. During the eight months subsequent to that agreement, milk prices had been equal to the Commission prices for two months only. One of these months (February) had been marked by an unorganized milk strike, and the price for the other month (June) had been agreed upon as a compromise with little reference to the findings of the Commission. The milk producers disclaimed all that of ever again referring their difficulties to a commission and announced their willingness in the future to meet the dealers and fix prices, under the protection of the Food Administration, upon any basis which would give them cost of production plus a fair profit.¹

Accordingly in June, the producers and the dealers met with Mr. Lamb and adopted the cost formula which had been used by the Milk Commission for distributing, on a percentage basis, the costs of producing milk. Under the

¹Milk News, Apr., 1918, p.2.

new agreement, however, prices were to be determined by applying current values of feed and labor to the formula without reference to the base period of prices used by the Commission.

The formula adopted was a modification of the one presented by Pearson and has since become widely known as the "Modified Pearson Formula". Because of the difficulty of determining the value of silage which has no real market, the 188 pounds of silage involved in the original formula was translated into terms of hay and labor. The new formula then called for the following amounts of feed and labor to produce 100 pounds of milk:

24 pounds of mill feeds

20 pounds of farm-raised grain

110 pounds of hay

3 hours of man labor.

This represented the average year cost of producing milk and in order to obtain the cost for any one month, the percentage differential for the corresponding month was to be applied. These monthly percentages were slightly modified by assuming that the September price represented 100 percent, or the average of the year. This gave the following seasonal differentials:

January	117	July	85
February	112	August	95
March	105	September	100
April	95	October	107
May	80	November	115
June	70	December	119

It was agreed that the average value of Illinois and Wisconsin corn as furnished by the Bureau of Crop Estimates of the United States Department

of Agriculture should represent the value of the farm-raised grain. The price of mill feed was taken as the average wholesale price in the Chicago district of the following feeds: Ajax, Unicorn, Sucrene, International Special Dairy Feed, RKD Dairy Feed, Schumacher, gluten feed, hominy feed, brewers' grains, cottonseed meal, linseed oil meal, bran, and middlings. To this was added for the first three months, \$ 5 per ton to cover freight, dealers' profits, and the cost of hauling the feed to the farm. After October, 1918, this amount was increased to \$ 7. During the period of this study, a few changes in this list of mill feeds were necessitated by the withdrawal of feeds from the market but substitutions were made so that the average price was unaffected. The value of hay in the cost computations was taken as the average farm value of all kinds of hay in Illinois and Wisconsin as quoted by the Bureau of Crop Estimates. A labor rate of 30 cents per hour was agreed upon and has been used in the computations throughout the period. These conditions were acceptable to both the producers and the dealers, and this method of price determination was put into effect for the first time in August, 1918.

In this manner was developed the formula cost method of determining milk prices to meet an emergency created by the abnormal conditions arising from the World War. That this method successfully fulfilled the requirements of the time, has already been shown (page 5) but that it would have failed had it been continued thru the next three years is evident from a comparison of formula and real prices (Table 1 and Fig. 1). In the following pages will be considered some of the possible reasons why the cost formula could not have been successfully used as a milk price determinant during the years following the expiration of the agreement.

III. THE DIFFERENCE BETWEEN THE REAL AND THE FORMULA COST OF PRODUCING MILK

In attempting to explain the economic phenomenon of the over-production of milk for a long period when milk prices were much below the theoretical cost of production, the first and most obvious explanation suggested is that of an inaccurate formula for computing the cost. If the formula called for more pounds of feed and hours of labor than were actually required to produce 100 pounds of milk, it is quite evident that milk could be produced at a profit if the price was somewhat below the inflated cost of production as computed by the faulty formula. However, it must be remembered that the original data upon which the formula is based, were supervised and collected by disinterested men who had been trained for the work. Furthermore, the original cost accounts were not conducted for the purpose of obtaining data for use in price determination and it was not until two years after their compilation that the question of fixing milk prices arose. Hence, the farmers who co-operated with the Department of Dairy Husbandry in keeping these accounts would have had no incentive for falsifying their records. These facts, together with the corroborating data of the other investigators who studied the cost of producing milk under like conditions, justify the conclusion that the formula used in determining milk prices was approximately correct as regards the average amounts of feed and labor required for the production of 100 pounds of milk. Such a conclusion, however, does not preclude criticism of both the formula and the method of its application.

Individual Costs Vary From the Average Cost

One of the chief defects of the "Modified Pearson Formula" is the fact that it is based upon the average cost of production. In the original study¹, all costs of production, whether in values or in units of commodities, were simple arithmetical means of the costs on all of the farms, and the formula derived from these data assumes that milk prices can be successfully determined upon the basis of such average costs. In practice, however, the cost of producing milk may vary widely on different farms in the same locality. In fact, the cost of producing milk on the 36 farms involved in Pearson's study ranged from \$ 1.21 to \$ 3.11 per 100 pounds. This variation was due in part to seasonal production. Milk can be produced in the summer months at much lower cost than during the winter because of the cheap feed furnished by summer pastures and because of the greater amount of labor required during the winter. Some of the farms studied practiced summer dairying; others centered the bulk of the year's production in the winter months; while a few produced a uniform amount during the entire year. These seasonal differences in the cost of producing milk on the different farms do not introduce errors in the formula based upon average costs for the whole group, provided the seasonal differentials applied to the computed year cost have been correctly selected to compensate for the variations. However, not all of the variations in the cost of producing milk are due to seasonal production and these other factors are the ones which interfere with the successful application of cost formulas in determining milk prices.

¹Pearson, F. A., The Cost of Milk Production, Ill. Agr. Exp. Sta. Bul. 213, 1919.

A study of the principal factors causing variation in the cost of producing milk shows the wide range in cost which is possible. Some of these factors affect the unit requirements of producing milk, while others affect only values. A few affect both unit requirements and values. Chief among these is the variation in the amount of milk produced annually by a cow. This affects three items of expense: (1) housing, (2) labor, and (3) feed.

It is quite evident that the expense of housing a high producing cow is the same as that of housing a low producing cow. Hence, the cost per 100 pounds of milk decreases as the production per cow increases. This item of cost is a minor one and amounted to less than four percent of the total cost on the farms studied by Pearson but it illustrated the danger of the generalization that the minor costs of producing milk equal the returns not milk (page 18). Altho this may hold true for the average of a group of farms, it may be seen that on farms with a housing cost lower than the average, the returns not milk may be larger than the miscellaneous costs and therefore these dairymen would get a profit which does not appear in the formula price. Such a profit would necessarily be small but milk is produced upon a very narrow margin and even this difference might be great enough to induce a farmer to continue dairying when a formula cost of production would indicate that he was selling his milk at a loss.

There is also a negative correlation between the annual production of milk per cow and the labor requirement per 100 pounds of milk. Slightly more labor is required in milking and caring for a high producing cow than is required for a poor cow but the increase is not proportional to the increased milk yield so that the requirement per 100 pounds of milk is appreciably less for the better cows. Hence, altho the formula calls for a fixed amount of labor per hundredweight of milk (3 hours), a dairyman with a herd of high

producing cows may be able to produce milk with less than this amount of labor thereby lowering his cost to a point below the average.

The amount of feed required to produce 100 pounds of milk is another important item which is influenced by the annual production of milk per cow. A recent study¹ of the feed consumed and the milk produced by 1,605 Holstein cows indicates how widely the feed consumption may vary from the average requirements given in the formula. Table 4 gives the data pertaining to the production of milk and fat by these cows and to their feed consumption. By computing the total digestible nutrients in the feed consumed by the different cows it is possible to compare the amounts of feed required to produce 100 pounds of milk by cows of various productivity. In the case of these 1,605 cows, the nutrients consumed per unit of product and the annual production of milk were found to be negatively correlated ($-0.4180 \pm .0133$). Their relation may be expressed by the following formula:

$$Y = \frac{3651.60}{X+36.75} + 14.95$$

where Y = the total digestible nutrients in the feed consumed per 100 pounds of milk and X = the annual production of milk in hundredweights. Stated in otherwords, as the production per cow increases, the nutrients consumed per 100 pounds of milk decreases at an ever decreasing rate. Fig. 3 shows this relation graphically. By the use of the above formula, the amount of feed required to produce 100 pounds of milk by cows of varying production may be compared with the requirement for the average cow of Pearson's study. Table 5 shows a number of such computations. From these data it may be seen that a cow with an annual production of 10,000 pounds requires 18 percent less feed to produce 100 pounds of milk than does a cow with an annual production equal to the average of all of the cows on the 36 farms studied by Pearson.

¹Unpublished data compiled by the author.

Table 4.- Relation Between the Annual Production of Milk per Cow and the Amount of Feed Consumed

Group	Production of milk per cow per annum	Number of cows	Average production per cow	Feed consumed annually per cow		
				Concentrates	Succulent roughage	Dry roughage
	Pounds		Pounds	Pounds	Pounds	Pounds
I	2,500-3,500	21	3,081	746	5,318	1,500
II	3,500-4,500	79	4,094	1,060	5,764	1,498
III	4,500-5,500	183	5,065	1,352	5,926	1,783
IV	5,500-6,500	254	6,032	1,562	6,279	1,997
V	6,500-7,500	309	7,013	1,767	6,494	2,167
VI	7,500-8,500	266	7,972	1,993	6,744	2,280
VII	8,500-9,500	221	8,956	2,230	6,762	2,311
VIII	9,500-10,500	137	9,938	2,564	6,748	2,365
IX	10,500-11,500	76	10,921	2,829	6,684	2,184
X	11,500-12,500	33	11,943	3,117	6,139	2,054
XI	12,500-13,500	19	12,864	3,769	6,600	2,522
XII	13,500-14,500	4	13,710	2,989	4,456	2,399
XIII	14,500-15,500	1	15,389	4,386	8,464	1,924
XIV	15,500-16,500	1	15,825	4,985	11,869	3,561
XV	16,500-17,500	1	16,711	4,261	5,849	2,089

Fig. 3 - Relation Between the Annual Production of Milk per Cow and the total Digestible Nutrients in the Feed Consumed per 100 Pounds of Milk

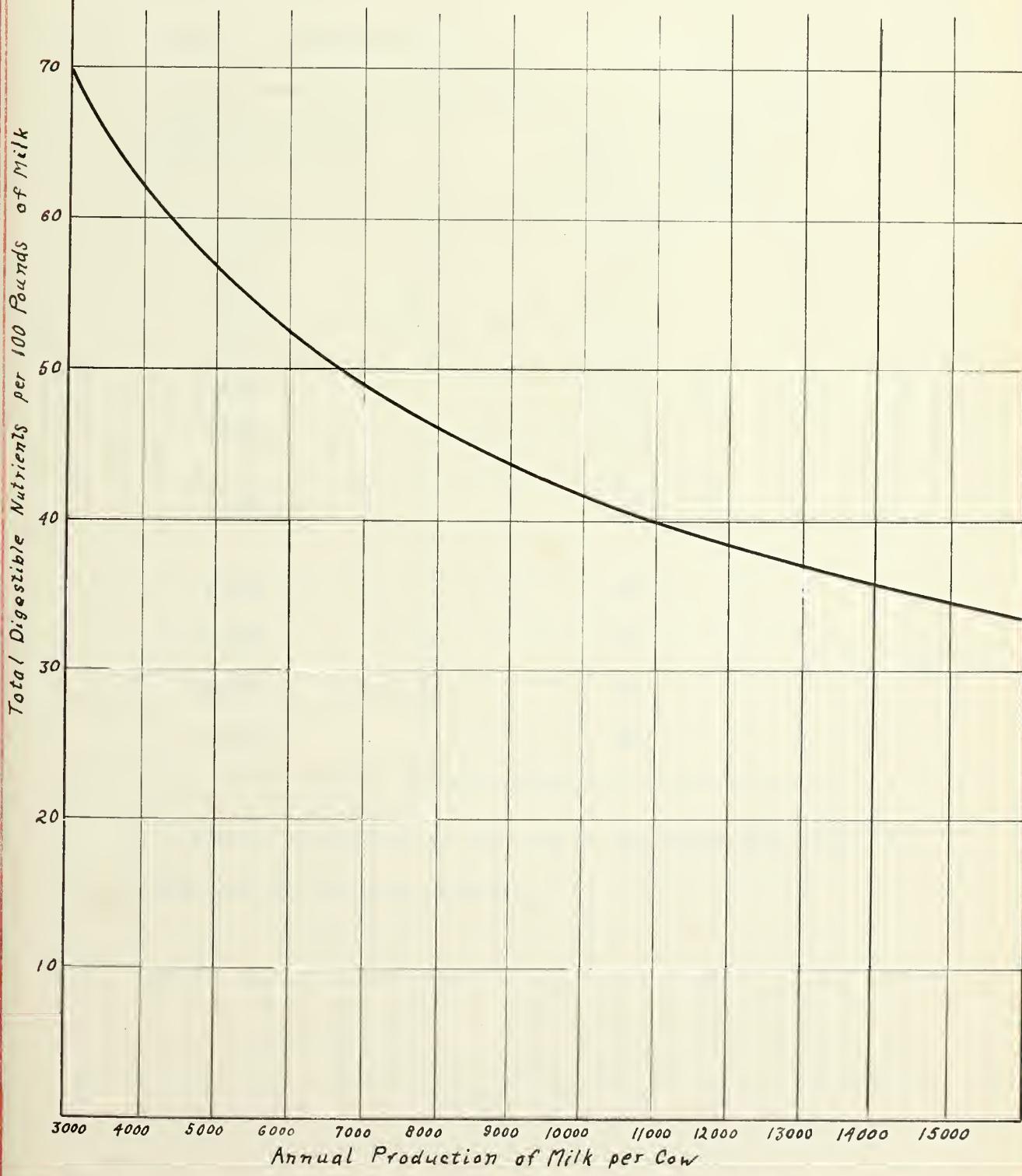


Table 5.- Relative Amounts of Feed Required to Produce 100 Pounds of Milk by Cows of Various Productivity

Annual production of milk per cow Pounds	Relative amounts of nutrients consumed per cwt. of milk		
		Percent	
3,000		137	
4,000		123	
5,000		112	
6,000		104	
6,511 ⁽¹⁾		100	
7,000		97	
8,000		91	
9,000		86	
10,000		82	

¹ Average production of the cows on the farms from which the data were obtained for the cost formula.

On the other hand, a cow which produces only 3,000 pounds of milk annually requires 37 percent more feed per hundredweight than the average cow upon which the formula is based. These data indicate the wide range in feed cost due to the variation in the annual production of milk per cow.

Overhead or fixed expense in dairying has already been considered in connection with the variation in the cost of milk production due to high and low producing cows, but in the previous discussion it was assumed that the investment per cow in buildings and equipment was uniform on the different farms. Such, however, is not the case. Some of the farms on which milk is produced for the Chicago market are improved with large well-built barns having modern equipment in the way of steel stanchions and mangers, individual watering cups, litter carriers, and ventilating systems. All of these things tend for convenience in caring for the cows but on many farms the barn and equipment may represent an investment of five or six thousand dollars. Interest upon this investment and depreciation of the buildings make a comparatively large item of expense in producing milk on these farms.

Upon other dairy farms in the same locality cow barns are little more than shelters for the cattle and represent an investment of but a few hundred dollars. The depreciation of these buildings and the interest on the capital invested in them constitute but a very small part of the cost of producing milk.

The difference in the cost of housing cows in these two classes of buildings may be illustrated by two dairy farms in DuPage County, Illinois.¹ On one of these farms the barn was of the type commonly found on the best dairy farms in that region and the cost of housing a cow for one year amounted to \$ 17.13. Within one and one-half miles of this farm was another dairy with

¹Cost Acct. Records 234 and 235, Dept. of Dairy Husb., Univ. of Ill.

a very small investment in buildings. The cost of housing a cow for one year on this farm was only \$ 2.10, or less than one-eighth of the cost on the neighboring farm. Neither of these dairies represented the extremes of investment in buildings. The one with the low housing cost complied fully with the Chicago health regulations regarding dairy buildings, and the one with the high cost was being operated as a practical dairy farm and should not be confused with the so-called "millionaire farm" which is rarely operated at a profit. Between these two classes of farms, are dairies showing all gradations of housing costs, each of which affects the cost of producing milk.

Another item of cost in the production of milk which may be considered as overhead expense is interest on the capital invested in the cattle. In the case of trade cows, this does not cause variation in the cost of producing milk because the value of trade cows is determined by the profit they will return, measured in part by the production of the cows. Therefore, although one dairymen may own a herd of cows which is twice as valuable as his neighbor's herd, the greater interest charge is approximately balanced by the increased profit due to the lower cost of production.

The value of a herd of good pure bred cattle is much greater than the value of a trade herd and it may seem that interest on the larger investment would, in this case, affect the cost of producing milk. However, the appreciation in value of young stock and the sale of calves would be greater for the pure bred cattle and this credit would be balanced against the miscellaneous costs of producing milk and the formula would therefore be unaffected. Hence, it may be concluded that variation in the interest due to different amounts of capital being invested in the cattle does not introduce any appreciable error in a formula which is based upon average costs.

In addition to these two important factors (production per cow and overhead expense) which cause variation in the cost of producing milk on different farms, there are numerous other causes of a minor character which have similar effects. Among these variable factors may be mentioned: distance of the farm from the plant or the shipping station; the farmers' ability as feeders to obtain a large milk yield economically; economies in buying feed thru car-load purchases by operators of large dairy farms; saving in labor resulting from the use of milking machines; losses from disease, especially from tuberculosis and abortion; special markets for surplus young stock from pure breed herds; etc.

All of these factors tend to divide dairymen into two classes. One group includes the farmers who are producing milk at a cost below the average of the entire district, and the other group includes those who are producing at a cost above the average. The latter group, or high cost producers, will be discussed in Chapter IV in which are considered the reasons for the continued production of milk when prices are below the actual as well as the theoretical cost of production.

The relation of the first group, or low cost producers, to the formula method of determining milk prices may be shown by a hypothetical case. Let it be assumed that milk prices in a dairy district supplying a certain city are to be fixed by the application of a cost formula which correctly measures the average cost of producing milk in that region. The better dairymen with a cost of production below the formula price are now making a profit, the magnitude of which is determined by their efficiency. The poorer dairymen with a cost above the formula price are losing money and it might be supposed that they would forsake dairying for a more profitable enterprise. For various reasons which will be discussed later, they continue the production of milk.

at an actual loss, and a part of the city's supply is therefore still obtained from this group. The efficient dairymen finding milk production profitable, attempt to enlarge their profits by purchasing or raising more cows and by increasing the production of those already owned by heavier feeding; or perhaps by increasing the frequency of milking from two to three times a day. Since the amount of low cost milk has been increased, the average cost for the entire district is now lower than the average at the time the formula was adopted.

The agreement for fixing milk prices on the formula basis does not provide that the people in the city shall consume all of the milk produced, and as the distributors must pay the old average cost of production, they cannot lower retail prices to stimulate consumption. The result is a surplus of milk which must be manufactured at a loss by the dealers or be disposed of in some manner by the producers. If the dealers take care of the surplus, they cannot long pay the formula price and remain in business except by increasing the retail price of milk which would curtail consumption and result in a still greater surplus. If the producer takes care of the surplus at a loss, he is not receiving the formula cost of production. In either event, the cost method of fixing milk prices has failed, even with this hypothetical case in which it was assumed that the formula correctly measured the average cost of milk production.

From the foregoing discussion it may be seen that not only does the cost of producing milk vary on different farms, but that the average cost fluctuates also, according to the proportionate amounts of milk produced by the more efficient and by the poorer dairymen. Furthermore, it appears that with a fixed price for milk, the new average will in all probability be lower than the old.

The Proportion of Purchased and Farm-grown Concentrates Fed to
Dairy Cattle Varies Under Different Conditions

The proportion of farm-grown and purchased feeds in the concentrate part of the cost formula was based upon the proportionate amounts fed on the 36 farms in Pearson's study (45 percent farm-grown and 55 percent purchased). During the period of his study (1914 to 1916), a normal relationship existed between the prices of farm-grown grains and purchased feeds (Fig. 2). After that time, however, the two classes of feeds were unequally affected by the factors determining prices and the result was a widely varying spread between the two price levels. For instance, it was shown (page 14) that during the fall of 1917, corn prices had advanced 201 percent over the pre-war period while mill feeds had increased but 71 percent. When conditions such as these prevail, dairymen find it profitable to sell their corn and to buy mill feeds, thereby changing the proportion of farm-grown and purchased feeds normally used. This suggests the possibility of producing milk at a cost somewhat below the formula price since the latter is based upon a fixed proportion (approximately equal parts) of purchased and farm-grown feeds. In other words, if dairymen use a greater proportion of the cheaper feed, the real cost of producing milk is less than the theoretical cost.

This is what actually occurred during the last fourteen months of the period covered by this study. The prices of all kinds of feeds declined but the price of corn fell at a much more rapid rate than mill feeds, and the result was an abnormal price relation which was just the reverse of the one which occurred in 1917 when the price of corn was relatively much higher than the price of mill feeds.

Table 6 and Fig. 4 show the ratio between mill feed and corn prices.

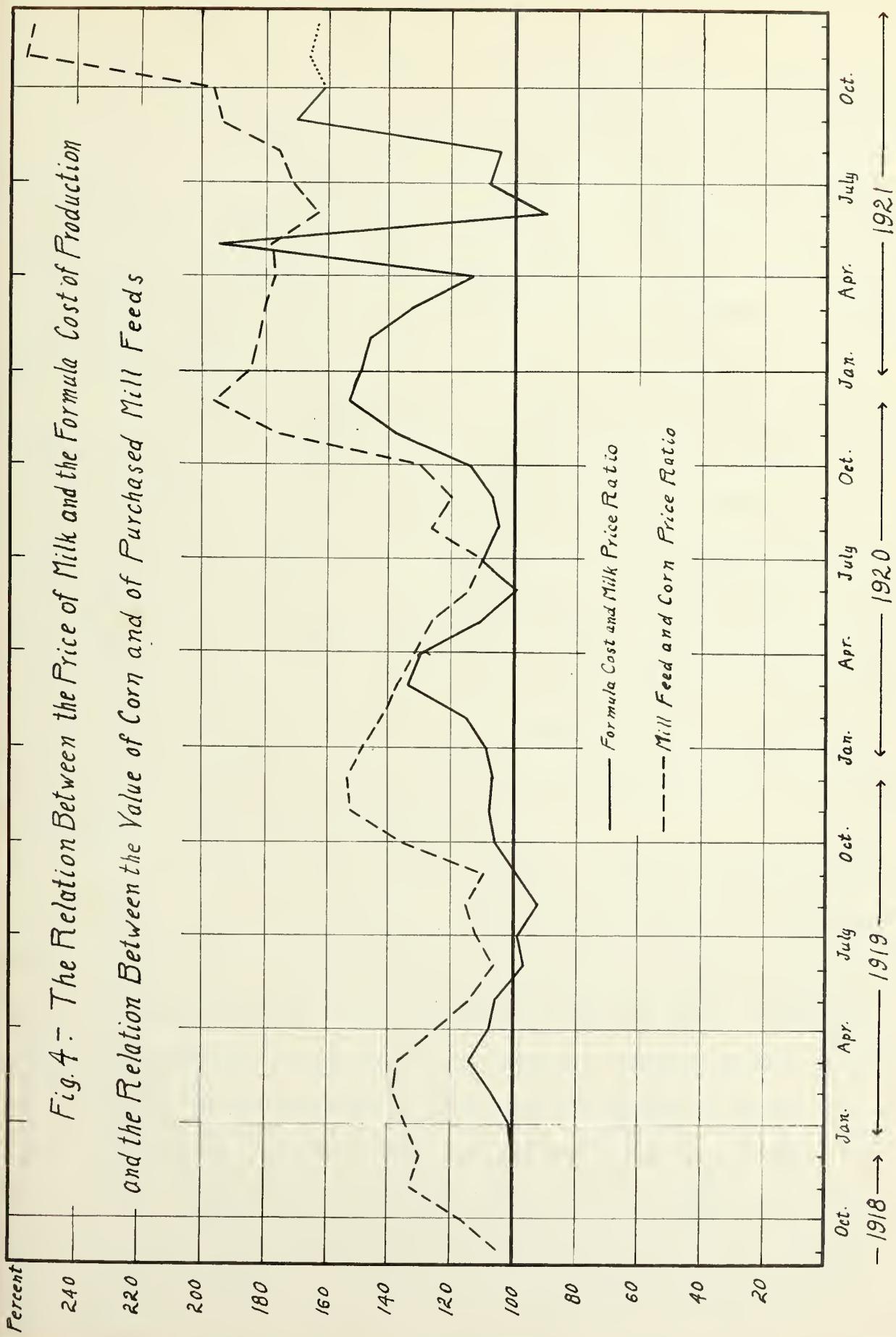
Table 6.- The Ratio of Corn and Mill Feed Prices ¹

Corn price = 100 percent

Year	1918	1919	1920	1921
Jan. -----	---	134	149	185
Feb. -----	---	138	142	182
Mar. -----	---	137	138	180
Apr. -----	---	125	132	177
May -----	---	114	127	178
June -----	---	107	115	163
July -----	---	112	110	171
Aug. -----	---	115	127	176
Sept. -----	105	110	120	194
Oct. -----	116	135	130	197
Nov. -----	133	152	176	257
Dec. -----	130	153	196	255

¹ Corn prices are the average of Illinois and Wisconsin farm prices from the U.S.D.A. Bur. of Crop Estimates.

Mill feeds are the average wholesale prices of fourteen feeds from the Western Feed Market Bureau and from manufacturer's quotations.



From September, 1918, to October, 1920, the average price of the fourteen mill feeds used in the formula price computations was 34 percent greater than the value of corn. The 1920 corn crop, however, sold at such low prices that altho mill feeds continued to decline, the average cost of the fourteen feeds was about 80 percent greater than the value of corn. This spread was increased to 150 percent by the decline in corn prices attending the harvest of the 1921 crop.

In Table 7 and in Fig. 4 also, is shown in the form of percentages, the ratio between the formula cost of producing milk and the price received by the farmers. A comparison of this ratio with the mill feed and corn ratio indicates that the proportion of farm-grown and purchased feeds varied with the relative prices of the two classes of feeds. In other words, since a surplus of milk was produced when milk prices were below the formula cost of production, it may be concluded from the correlation of the two ratios shown in Fig. 4, that the real cost of producing milk followed corn prices more closely than it did mill feed prices and this was possible only if a greater proportion of farm-grown grains was fed.

Were it not for the fact that the cost accounting studies on most of the farms involved in Pearson's study were discontinued before this period of abnormal price relations, it would be possible to compare the amounts of farm-grown and purchased feeds used during the period under consideration, with the proportion called for by the formula. However, records are available on three of the farms and Table 8 shows the changes in feeding practice which occurred on these farms during the period of relatively high-priced mill feeds. Each of the three farmers decreased the proportion of purchased feeds as the price of mill feeds became relatively much greater than the price of farm-grown feeds. Altho the number of records is too limited to draw any

Table 7.- The Ratio of Formula Costs and Milk Prices

¹Milk price = 100 percent

Year	1918	1919	1920	1921
Jan.	---	101	109	150
Feb.	---	107	116	147
Mar.	---	114	134	133
Apr.	---	108	130	114
May	---	106	111	195
June	---	97	100	90
July	---	99	110	108
Aug.	---	93	105	105
Sept.	100	99	107	171
Oct.	100	106	114	162
Nov.	100	108	138	166 ⁽²⁾
Dec.	100	107	153	164 ⁽²⁾

¹Prices received by the producers.

²Estimated because the November and December milk was only partly paid for by the Marketing Company. The ratio given represents dealers' price less 10 percent.

Table 8.- Relative Amounts of Purchased Concentrates Fed to
 Dairy Cattle on Three Farms During the Years Following the Development of
 the Cost of Production Formula¹

Farm number	Pearson's study 1914-1916	Percentage of total concentrates fed to dairy cattle			
		1918	1919	1920	1921
S-12	80	77	65	65	60
S-10	38	33	33	20	10
J-1	35	18	10	16	9
Average	51	43	36	34	26

¹Cost account records, Dept. of Dairy Husb., Univ. of Ill.

Upon a season, etc. A., etc. Geasorul, lost of, etc. Prologue, etc. Act. etc. etc. etc.

latter to a final seasonal cost of marketing this. The use of this
by prices paid for silk during a ten-year period, that is to an index date re-
was totalled out before, these differences were based upon a average
various percentages to obtain the formula cost for the different months. As
year 1935 was first compiled and this value thus obtained was multiplied by
in turn the formula method of determining unit prices, to avoid a

used in the formula

Inaccuracy of the seasonal index

change in the proportion of farm - town and rural-based feeds.
farm was approximately 28 percent less than the formula cost because of the
In other words, during 1931 the cost of concentrates on the same two

$$\frac{\text{Formula cost index}}{\text{Real cost index}} = \frac{151}{109} = 139 \text{ percent.}$$

Propportion	Price index	Cost index	Proportion	Price index	Cost index	Real cost	Formula cost
45 % corn	100	45	90	90	100	90	109
55 % mill feeds	193	106	100	100	193	106	151
100							100

may be estimated in the following manner:

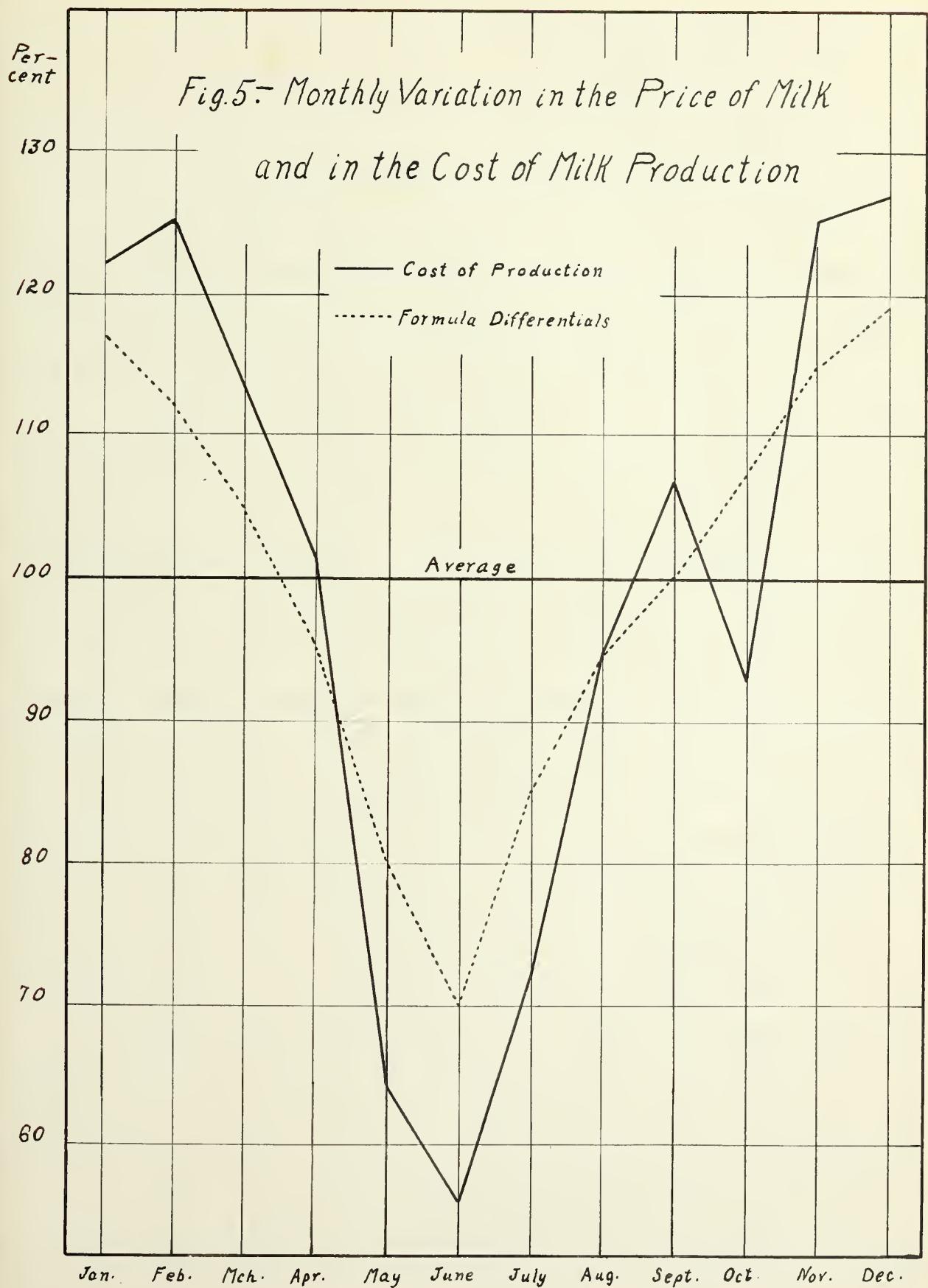
cost of concentrates on the two farms, S-10 and J-1, (Table 8) during 1931

The approximate amount by which this formula cost exceeded the real

chain that the proportion of rural-based feeds.

fairly accurately the tendency of the products in this relation in regard to

conclusions, it is probable that this increase of these same figures illustrates



cent of the average year price for the same period, at no time during the ten years was the December price 119 percent of that specific year's price. Instead it ranged from 107 percent to 132 percent for the different years. The other months showed similar variations thru the ten-year period, the extreme range for any one month being 30 percent for both January and February. In Table 9 is shown the monthly variation of prices from the yearly average. Four of the months (March, June, July, and December) have been selected for illustration and the variation for these months is shown graphically in Fig. 6.

It is evident from the wide variation of the different years from the ten-year average, that seasonal costs cannot be successfully distributed on any such basis of average monthly prices. If conditions were such in 1908 that a December price equivalent to 113 percent of the average for the year was sufficient to obtain an adequate supply of milk, and if the following year a December price equivalent to 133 percent of the average yearly price was necessary, it appears absurd to suppose that under a formula method of price determination, a uniform amount of milk would be produced year after year if the December price was maintained at 119 percent of the average year cost. The extreme climatic differences in various years and the varying economic factors affecting dairy markets cause a constant shifting of the relation between the monthly prices which are necessary to induce farmers to produce a sufficient amount of milk to supply a comparatively uniform demand.

It will be noted from Fig. 1 that the greatest difference between the formula cost and the milk price occurs each year during the months of January, February, March, April, and May. In other words, during this season the decline in the theoretical cost of producing milk has a tendency to lag behind the decline in milk prices. The uniformity with which this lag is repeated during each of the three years, 1910, 1920, and 1931, would indicate that the

Table 9.- Variation of Monthly Milk Prices from the Average

Annual Price

Percent

140

130

120

110

100

90

80

70

Fig 6. - Comparison of Formula Differentials
and Monthly Variation of Milk Prices, 1907-1916

Average Yearly Milk Price = 100 Percent

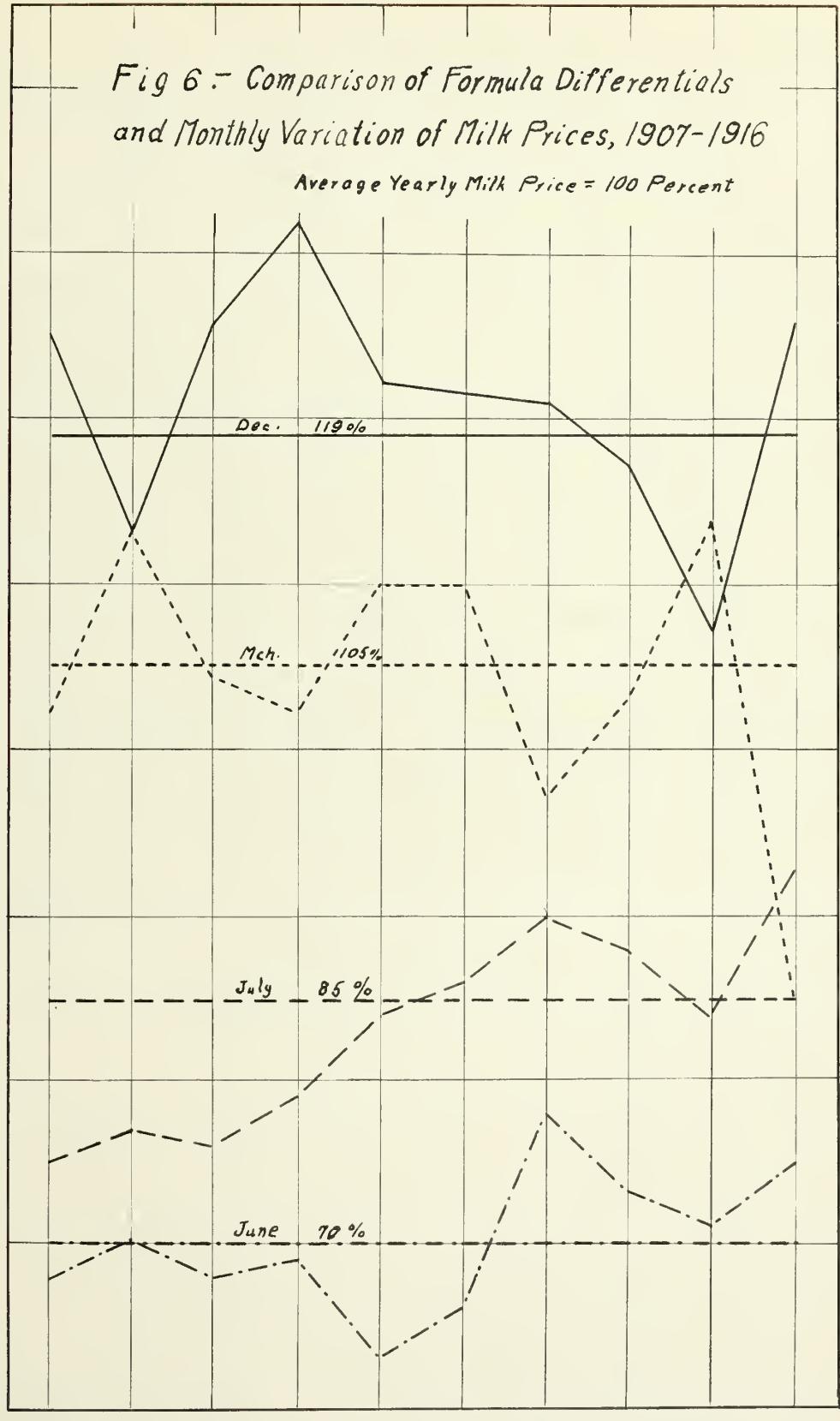
Dec. 119%

Mar. 105%

July 85%

June 70%

1907 1908 1909 1910 1911 1912 1913 1914 1915 1916



cause is to be found in the seasonal differentials which were not properly adjusted to the conditions then prevailing.

In the foregoing chapter it has been shown that the real cost of producing milk may be very different from the theoretical cost computed by the formula method. It is conceded that the formula used in the Chicago district represented with a fair degree of accuracy the average cost of producing milk at the time the data were compiled but it would appear that the average cost may fluctuate outside the limits of the formula. Under the conditions which prevailed during 1920 and 1921, it would seem that this fluctuating average cost was below the theoretical cost. If this was true, it explains the anomaly of the over-production of milk during these two years when the prices were below the formula cost of production. However, it is probable that this is but a partial explanation. There is abundant evidence that many dairymen produced milk at an actual loss during this period, and in the following chapter is discussed the reasons for the continuation of dairying by these losing producers.

IV. CAUSES OF THE CONTINUATION OF MILK PRODUCTION AT A LOSS

Market Conditions

Dairymen producing for the Chicago milk market are ever afraid that the milk produced in the great butter, cheese, and condensing region adjoining them on the north, may be diverted to the city and thus come into direct competition with their milk. That this is no idle fear, may be concluded from a comparision of the annual consumption of milk in Chicago and the amount sold within a reasonable shipping distance. In 1919, about three and one-half times as much milk as is normally consumed in Chicago, was sold within an area bounded by a 33-cent shipping rate for eight-gallon cans.¹ This amount included all milk sold whether for fluid consumption or for manufacture, but it indicates the enormous quantity of milk that is produced near enough Chicago to be shipped at a cost of one cent a quart or less.

Most of this milk which is produced in that part of the zone located in Illinois and Indiana is consumed in fluid form or is condensed. The Wisconsin region, however, offers several alternative markets, chief of which are: fluid markets, condenseries, cheese factories, and creameries. Not all of these markets are available to every dairymen in the zone, but enough men have a choice of methods of disposing of their milk so that they tend to maintain a normal price relationship between all of the markets. If cheese prices are high, some milk will be diverted from the condenseries and the creameries to the factories. If city milk prices are too high, milk will be drawn from all of these sources.

¹ 1920 Census.

A normal price relationship between the prices of milk for these four principal markets does not mean the same price for all. The difference in the season of production and the expense of handling the various classes of milk result in different price levels within the same region. Normally the price of milk for fluid consumption is highest, and the prices of milk for condensing, cheese making, and butter making, decrease in the order named.

Before the beginning of the World War our exports of condensed milk were practically negligible, but by 1919 the business had grown to enormous proportions. In that year over two billion pounds of milk (approximately three times the amount consumed by Chicago) was exported in the form of condensed and evaporated milk. Our butter exports for the same year required the production of about one-fourth of that amount of milk. Milk production in the Wisconsin and northern Illinois regions was greatly stimulated by the high prices which resulted. New condenseries were opened and the prices for condensing milk were maintained on a par with Chicago fluid milk prices.

In October, 1920, the market went to pieces. For some months previous to this time, large stocks of condensed milk had been accumulating in the warehouses because of the falling off of the export demand. On September 1, the total stock of unsold condensed and evaporated milk in New York was 1,062 percent greater than on the same day the year previous.¹ Condenseries all over the country closed down or made large reductions in the price paid for October milk. In the Chicago district, part of this milk which had been produced for condensing came into direct competition with the city supply and, because of the pooling system, that which was sold or manufactured by the Marketing Company, still further depressed the prices obtained by the farmers

¹Monthly Condensed and Evaporated Milk Market Report, 13, Sept. 28, 1920, U. S. D. A. Bur. of Markets.

who were selling on the city market. To add to the general surplus of milk in 1920, almost as much butter was imported as had been exported in 1919. Fig. 7 which is adapted from a chart prepared by the Dairy Division of the Department of Agriculture, shows the balance of trade in dairy products from 1913 to 1921.

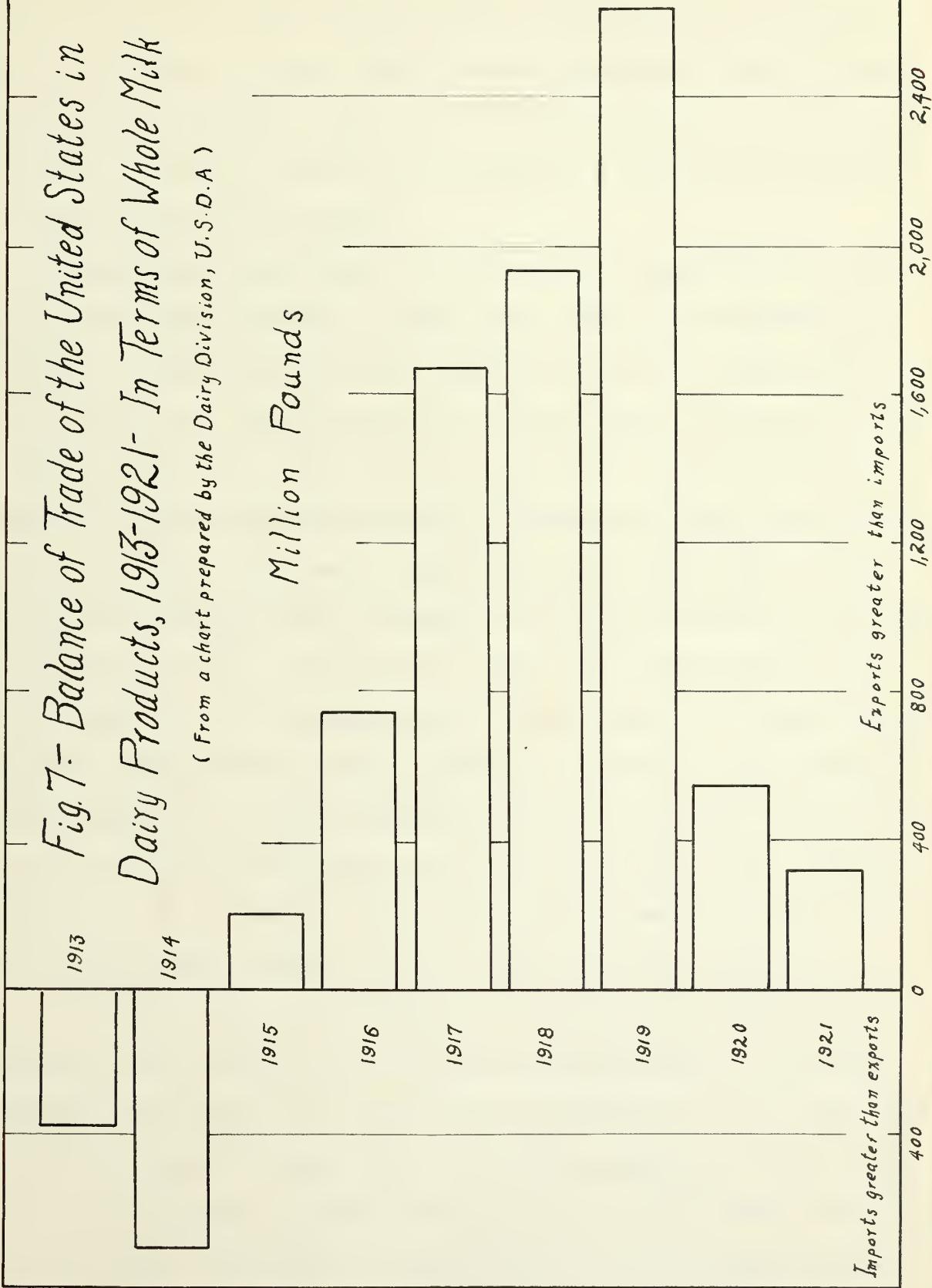
The export market conditions undoubtedly caused city milk prices to be depressed during 1920 and 1921, and account to some extent for the difference between the cost of producing milk and the prices obtained. There still remains to be explained, however, the reason for the continued production of milk at these low prices over such a long period. The fact that some milk is produced at a loss is of great importance in any method of price determination, and a few of the reasons for this sub-marginal production will be discussed here.

Difficulty of Changing the Type of Farming

A type of farming once established in a region is exceedingly difficult to change. Aside from conservatism, a purely psychological factor which causes the continuation of an unprofitable type of farming, important economic considerations are involved. For instance, if a dairymen in the Chicago district contemplates changing to a more profitable type of farming because a demoralized market does not afford a price for milk equal to its cost of production, he is confronted with various problems.

In the first place, he must sell his herd at a sacrifice because the value of dairy cattle tends to rise and fall with the profitableness or unprofitableness of the dairy industry. He knows that should conditions change so that dairying would again be profitable, he would be unable to buy back

Fig. 7.- Balance of Trade of the United States in
 Dairy Products, 1913-1921- In Terms of Whole Milk
 (From a chart prepared by the Dairy Division, U.S.D.A.)



the herd which he had built up thru years of careful breeding and selection. Altho he might gather together a good herd by the purchase of cows from reliable dairymen and breeders, such a course would be attended with risk and, at best, would be expensive because, with dairying on a more profitable basis, dairy cattle prices would be higher.

This factor, which hinders the free shifting from dairying to some more profitable type of farming and back again, was much less important ten or fifteen years ago than it is now. At that time it was a common practice among dairymen in the Chicago district to purchase fresh cows in the Wisconsin butter and cheese region, milk them thru the greater part of the lactation period, and then sell them for slaughter. The purchase price of the cow was usually only a little more than the price she would bring for beef, and by this practice, dairymen avoided the expense of feeding and caring for dry cows. In recent years, however, the value of a fresh cow has been relatively much greater than her value for slaughter and this has tended to discourage the replacement of cows that was formerly practiced. In addition, the cheaper production of milk by high producing cows has induced many dairymen to build up their herds by raising the heifer calves sired by pure bred bulls. Improvement of a herd by this method is slow, and a dairyman who has built up a good herd is loath to sell even tho he may be producing milk at a loss.

A second problem which confronts the dairyman who is thinking of selling his herd is the question of maintaining the fertility of his farm. Relatively little plant food is removed from the farm by the sale of milk, and if the manure produced by dairy cattle is properly handled, the fertility of the soil can be increased instead of being depleted as occurs when grain farming is practiced. This factor is important even on tenant-operated farms because share-renting is the more common form of land tenure and the tenant

is therefore unable to change to grain farming without the consent of the land owner. In fact this is true for practically all cash-rented farms as well, and some cash-leases go so far as to stipulate that no roughages shall be sold from the farm and any grain that may be sold must be replaced with an equal amount of purchased feed.¹

The problem of fertility maintenance can be solved by substituting beef cattle and hogs for dairy cattle but this assumes that the feeding of these two classes of animals is more profitable than dairying. During the last two years of the period under consideration, hog-feeding was relatively profitable but steer-feeding was not. Hogs, however, are least able to utilize the large amount of permanent pastures found on these farms and this, together with the fact that the soil and climate are not particularly favorable for corn, tends to prevent dairymen from changing to hog-raising as the major enterprise.

The large investment in buildings on many farms has already been mentioned and these expensive barns are of little use if the farmer discontinues dairying in favor of grain farming. Even if steers are fed, the barns are rarely arranged so that they can be used for that purpose without some remodelling. An illustration of this may be had in the case of two of the farms included in Pearson's study.² Both of these farmers discontinued dairying and started to feed beef cattle. On one farm a barn worth \$ 2,000 was remodelled at a cost of \$ 515, and on the other farm the change from dairying to steer-feeding required alterations costing \$ 131 on a barn worth \$ 1,000. In

¹Hibbard, B. H., and Black, J. D., Farm Leasing Systems in Wisconsin, Wis. Agr. Exp. Sta. Research Bul. 47, 1920.

²Cost Account Records R-1 and R-2, Dept. of Dairy Husb., Univ. of Ill.

neither case was the barn as efficiently utilized as when it contained dairy cattle. It may be added incidentally, that in three years these men lost a total of \$ 5,676 on the seven car-loads of steers which were fed.

When dairying is discontinued in favor of some other type of farming, another change is involved which is far more important than building alterations. The whole plan of labor utilization is upset. If the farmer has been practicing winter-dairying, it may mean that he can dispense with one or more farm hands during the winter months, but with the advent of the cropping season he cannot do all the field work alone. He is therefore compelled to depend upon the unsatisfactory help supplied by the migratory group of farm laborers which are available at that time, or to pay a good farm hand during the winter when his labor is not very productive. Even if the farm unit is small enough to be operated as a dairy by one man, the disposal of his herd is likely to mean less efficient utilization of his own labor.

These are but a few of the factors which tend to prevent the easy shifting from one type of farming to another. In all, they are strong enough to force many men to continue dairying at an actual loss even when they are aware of the fact that their business is unprofitable. In addition there are many men producing milk at a loss, year after year, who think that their cows are returning a profit. Relatively few farmers keep even simple accounts and practically none keep cost accounts. It is true that most small merchants and manufactures do little better than farmers in so far as cost accounting is concerned, but should their losses continue, they would soon be forced out of business. Many dairymen, on the other hand, because of the nature of their business, may continue to produce milk at a loss for a period of years and during that time, their financial worth may be steadily increasing. This occurs because dairying is not kept distinct from the other productive

enterprises of the farm, and without proper allocation of costs, it is natural that much confusion should exist in the minds of the operators regarding the profits of one branch of their business.

Feed Charged at Cost of Production

The lack of any adequate system of accounting on most dairy farms results in the continuation of dairying by a large group of sub-marginal milk producers. So long as their business as a whole is not losing money, these men are unable to determine whether or not the dairy enterprise is profitable. This is largely due to the fact that there is a tendency to look upon the farm as a unit in thinking of the cost of milk production. Farm-grown feeds are fed to the dairy cattle without considering whether or not greater profit could be obtained by selling the grain or hay. Any profit which accrues to the whole farm business is credited to the dairy cattle because milk production constitutes the principal live stock enterprise. In effect, this practice is the same as the method of charging feeds at cost of production which was so strongly opposed by the producers at the Milk Inquiry. This procedure tends to keep many farmers in the dairy industry who would realize greater profits from the sale of a part or all of their crops. The milk produced by these men increases the supply available for the city market and therefore depresses the price to all the producers.

Over-estimation of the Returns Not Milk

On many farms, even where dairying is viewed as a distinct productive enterprise, feed alone is considered in estimating the cost of milk production. This is due to the frequently made statement, that the value of the calves

and the manure produced by a herd is equal to the cost of labor and the miscellaneous items of expense.¹ Altho the publicity given the cost data at the Milk Inquiry tended to dispel this belief, it still exists in the minds of many dairymen who are unfamiliar with the facts disclosed by cost investigations, or who disagree with the conclusions of the investigators.

This erroneous opinion has developed largely from over-estimating the value of the manure produced per cow. It is estimated that a cow produces twelve to fifteen tons of manure a year² which contains approximately 12 pounds of nitrogen, 3 pounds of phosphoric acid, and 9 pounds of potash per ton.³ At the average prices which prevailed during the four years, 1918 to 1921, (nitrogen, 34.2 cents; phosphoric acid, 9.2 cents; and potash, 22.0 cents)⁴, equal amounts of fertilizing constituents if purchased in commercial form would cost \$ 6.15 for each ton of manure produced. On this basis the manure produced annually by a cow would be worth from \$ 74 to \$ 92.

There are, however, several errors involved in this method of computing the value of manure. In the first place, altho a cow produces twelve to fifteen tons of manure annually, less than half of this amount is recovered and applied to the fields because of the methods of handling manure common to Illinois dairy farms. The balance is dropped while the cows are on pasture or is lost because of rotting or leaching. Since most of the pastures

¹Davis, H. P., Bossy As Buyer, Hoard's Dairyman, Dec. 9, 1921, p. 612.

²Roberts, I. P., The Production and Care of Farm Manures, Cornell Univ. Agr. Exp. Sta. Bul. 27, pp. 29-42, 1891.

Hart, E. B., Getting the Most Profit from Farm Manure, Wis. Agr. Exp. Sta. Bul. 221, pp. 1-34, 1912.

Duley, F. L., Handling Farm Manure, Mo., Agr. Exp. Sta. Bul. 166, 1919.

³Henry and Morrison, Feeds and Feeding, p. 278.

⁴Van Slyke, L. L., Changes in the Composition and Cost of Fertilizers in New York from 1914 to 1921, N. Y. (Geneva) Agr. Exp. Sta. Bul. 493, pp. 10-11, 1922.

in the Chicago dairy district are either boggy or hilly and do not come under cultivation, the manure which they receive has much less value than that which is applied to the tillable land. From a study of 224 dairy farms in Illinois¹ it was found that the average amount of manure, including bedding materials, recovered and applied to the fields was only 6.6 loads per cow per year,² approximately one-half of the estimated production.

The fallacy of valuing manure at the cost of its chief fertilizing constituents in commercial form, lies in the fact that the purchase of commercial fertilizers by dairymen in the Chicago district is not profitable and the use of these fertilizers is unusual. Therefore, by crediting the cows for the manure at commercial fertilizer prices, dairymen are adding to their cost of producing crops, an amount greater than is justified by the increased yield. The real value of manure depends upon the soil, the method of applying the manure, and the prices of farm products, and is therefore difficult to determine.³ It is evident, however, that the total value of the manure produced by a cow is very much less than is estimated by dairymen who balance all costs of dairy-ing except feed, against the value of the manure and the calves.

Confusion of Wages and Profits

In addition to the dairymen who consider the value of the manure and the calves a satisfactory return for their labor and for the miscellaneous costs of producing milk, there are many dairymen who think of costs only in terms of feed and cash expenditures. Interest paid at the bank for money

¹Ross, H. A., The Production and Utilization of Manure on Illinois Dairy Farms, Ill. Agr. Exp. Sta. Bul. 240, 1922.

²A load weighs about one ton.

³Pearson valued the manure recovered at \$ 1 per load.

borrowed to buy feed or cattle is recognized as a cost of producing milk but interest upon the invested capital is not considered an expense. A veterinary fee for a sick cow is charged to the cost of producing milk but if the cow dies, her death is looked upon as one of the unavoidable risks of the business and is figuratively written off as a loss. The cost of the frequent replacement of milk cans which is necessary because of the rough handling which they receive in shipment, looms large in the eyes of these dairymen but the depreciation of barns and silos which constitutes a far greater expense is entirely overlooked. It is to be expected, therefore, that this class of dairymen would have a somewhat vague conception of the labor cost of producing milk, particularly if no hired labor is involved. All too often, the dairyman contributes not only his own labor but also that of his wife and children, and classes as profit all income over the feed costs and actual expenditures. His conception of profits, however, usually includes wages of labor, managerial wages, and true profits. If the dairyman's family includes several children old enough to help with the milking and other work about the dairy, his expenditure for labor may be practically nothing and he therefore estimates his cost of producing milk at a very low figure.

There is nothing strange in the fact that profits, wages of labor, managerial wages, and interest are often confused in the mind of a dairyman who is capitalist, manager, and laborer, in one. He is primarily interested in obtaining the greatest possible income from all sources but he rarely attempts to separate the productive factors in his business to see if he is getting the normal return from each. If conditions are such that the returns for his labor are less than the wages of a farm hand, he cannot go on strike like the union worker because the capital invested in his business is his own. As long as the adverse conditions exist, he must continue to produce milk and

to receive a low wage unless an alternative type of farming proves more profitable.

There is some question as to the soundness of charging labor at a uniform rate thru the entire year as was done in the formula cost computations. The rate used (30 cents per hour) was the approximate wage, including perquisites, received by farm hands and appears, therefore, to be rather a low wage for the somewhat superior grade of labor furnished by the farm operator. On the other hand, the operator would receive little or nothing for his labor during the winter if he was a grain farmer. With this fact in mind, it is not surprising that even a low wage for the labor of a dairyman and his family seems preferable to no income during the winter months. The result is the production of a large amount of milk during the winter and its sale at prices which may not pay the current wage for the labor involved.

Significance of Sub-marginal Milk Production

These factors which cause the continuation of milk production at a loss must be taken into account in studying the discrepancy between the computed cost of production and the price received for milk during the last two years of the period studied. It is probable that because of market conditions during that time, a much greater proportion of the dairymen were producing milk at a loss than is normally the case, but on account of the difficulty of changing to a more profitable type of farming they were compelled to continue. It would seem, however, that even under normal conditions, a very large group of farmers produce milk and sell it at prices which are below the real cost of production. This is due, in part to the practical difficulties with which they are confronted if dairying is discontinued, and in part to their ignorance of the real cost of producing milk.

These men constitute the group of sub-marginal producers which were discussed in connection with the variation in the cost of producing milk (page 41). The fact that this group can continue dairying at the expense of their other farm enterprises, means that cost of production acting thru supply does not determine the lower limit of prices. In other words, the minimum price for milk is determined by the sub-marginal producer and not by the marginal producer. The number of these sub-marginal producers varies under different conditions, decreasing during periods of favorable markets and increasing during periods of market demoralization such as occurred during the latter part of 1920 and all of 1921. These farmers are justly blamed by the more efficient dairymen for their share in flooding the market and causing low milk prices but such criticisms are of no avail in curtailing production and decreasing the surplus. If these sub-marginal producers were dairying intensively, their losses would soon become apparent, but most of them are milking but a few cows and a small loss may be more than covered by the profits from the other productive enterprises. There is therefore no possibility of completely checking this unprofitable production but the best interest of both the efficient and the inefficient producers demands that it be kept at a minimum.

V. PRACTICABILITY OF FIXING MILK PRICES BY THE USE OF COST FORMULAS

The idea of fixing milk prices at cost of production plus a fair profit naturally makes a strong appeal to dairymen who consider such a method to be nothing more than economic justice. As recently as February, 1922, the use of the cost method was attempted by the Dairymen's League Co-operative Association, an organization of dairymen producing milk for the New York market.¹ Prices were to be determined by the use of the Warren Cost Formula (page 20) but after one month's use it was found that the market conditions would not justify the payment of the formula prices and the plan was temporarily abandoned.

In the Chicago district also, a large group of dairymen are demanding that prices be set at cost of production plus a fair profit,² apparently believing that an agreement to use this method of price determination is all that is necessary for a successful solution of their marketing problem. These men overlook the fact that during the last two or three years, a great surplus of milk was produced and sold at prices below the formula computations. How much greater this surplus would have been had the prices been as high as the formula costs, may be surmised. As has been shown (Chapters III and IV) this over-production of milk when prices were below the computed cost was due to two causes:

1. The theoretical cost, computed by the use of the "formula, was probably somewhat higher than the average cost of production for the Chicago district, and very much higher than the individual costs for a large proportion of the producers.

¹Hoard's Dairymen, Feb. 10, 1922, p. 118.

²Milk News, Oct. 1921, p. 1.

2. The real cost of producing milk on a very large number of farms in this region was greater than the price received for milk, but because of the difficulty of changing to another type of farming or because of ignorance as to the real cost of producing milk, many of these sub-marginal producers continued dairying at the expense of their other farm enterprises.

Should the cost of production method of determining milk prices again be adopted in the Chicago district, the two factors just mentioned would still exist and as a result, periods of over-production would in all probability follow. Even with a modification of the formula, no accurate measure of the real cost of producing milk could be obtained, particularly as regards the seasonal cost, because of the constantly changing conditions affecting production and because of the inflexibility of the cost formula which could not well be changed with the varying conditions.

Theoretically, at least, the cost of production method of determining milk prices takes account of one of the two factors (supply and demand) which tend to regulate prices. However, the second of these two factors (demand) is completely ignored in this method of fixing prices and hence the supply which would be produced might be entirely out of proportion to the consumers' demand. If the resulting surplus could be converted into the various dairy products and the lower price obtained for the milk in this form be distributed to the producers in the form of a pool price, the cost method of fixing milk prices would have a better chance of success. This was the plan of the Dairymen's League Co-operative Association but competition, which prevented the successful use of the formula in this case, would undoubtedly be effective in other pooling associations. The pool price was necessarily lower than the fluid milk price and in order to obtain the higher price, many dairymen refused to join the pooling association or withdrew from it if they were members, and

sold their milk direct to the dealers, thus getting the benefit of the higher price without bearing their share of the surplus.

The Dairymen's League Co-operative Association at the present time (July, 1922) is in the midst of a fight with the New York dealers as the result of trying to overcome this condition. By means of a "preferential payment" contract with the dealers which provides for the payment of lower prices to non-members,¹ the association is attempting to force the "non-poolers" into their organization. A number of the New York dealers have refused to sign the contracts and are buying their milk outside of the Dairymen's League Co-operative Association.² The probable outcome of this fight can only be surmised but should the association win, one obstacle in the way of determining city milk prices on the formula basis will have been removed. However, the difference between the fluid milk price and the pool price will remain as a constant threat against the solidarity of the organization, and should the spread become too wide, it might result in the complete breakdown of the pooling method of marketing milk, similar to the breakdown which occurred in the case of the Milk Producers Co-operative Marketing Company in the Chicago district (page 9).

It would appear from this study of the cost formula, that under our competitive system of milk production and distribution, the cost of production method of determining milk prices cannot be successfully used as an automatic price regulator. With the present over-production of milk, the adoption of such a method by the dairymen's co-operative association in the Chicago district would be to invite disaster because of the still heavier production which would be stimulated by the higher prices and because of the milk which would

¹Dealers' contract, April, 1922.

²Dairymen's League News, Apr. 7, 1922, p. 1.

be diverted to the city from the butter, cheese, and condensing region. It is perhaps fortunate for the dairy industry about Chicago that the producers' co-operative organization is not strong enough to force the adoption of this method of fixing milk prices.

Altho the cost of production formula has little to recommend it as an automatic price determinant, it may serve as a starting point for collective bargaining. Cost computations show the general trend of costs much as index numbers show the general trend of prices. They may therefore give a somewhat concrete basis for estimating the price necessary to induce dairy-men to produce a sufficient amount of milk to supply the market without flooding it. Sound judgment is necessary on the part of both the producers' representatives and the dealers in order to modify the computed price so that it is in accord with the prevailing conditions affecting milk production and with the prices of other dairy products.

Altho the cost computations are sent each month to the (Chicago) Milk Producers Association and to the Milk Producers Co-operative Marketing Company, neither of these associations appears to be effectively functioning as a bargaining agent and the part that the formula cost computations play in setting milk prices at the present time is therefore very slight. With the exception of one company which has recently made a request for the cost of production computations,¹ the milk dealers have evinced no interest in these figures.

If the formula cost of production is to be used as a basis for bargaining, the monthly computations should be given a large amount of publicity among both the consumers and the producers. When milk prices advance, some decrease in the amount of milk consumed is to be expected but this decrease is greater than the price warrants and is the result of a peculiar state of mind

¹Letter from the Richmond-Smith Company, March 17, 1922.

of the consumer, who feels that farmers are taking an unfair advantage by acting collectively. In the past the city press has been largely responsible for this attitude of the consumers because of its attacks upon the producers who were often characterized as "profiteers", "robbers", and "infanticides". More recently, the problems of the dairymen have been better understood and the city newspapers in most cases have shown a spirit of fairness in discussing the milk situation.

Publication of the monthly cost of production computations would do much to overcome the antagonistic attitude of the consumers when increased costs necessitate an advance in milk prices. If the consumers feel that the price advance is not merely the result of the producers using their collective power to increase their profits, there is less of a tendency to decrease the amount of milk consumed and the demand is therefore better maintained.

Wide distribution of the cost of production computations among the milk producers at times when the formula cost was above the milk price, might possibly have some effect in decreasing the amount of milk produced. Whether the sub-marginal or the more efficient producers would be most likely to decrease their production, is a matter of speculation but the result in either case would be to increase milk prices.

It may therefore be concluded that the formula cost of milk production may be valuable as a basis for collective bargaining and as a means of informing both producers and consumers as to the general trend of costs but its use as an automatic milk price determinant is economically unsound.

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